Application of Advanced Computational Procedures for Modeling Solar-Wind Interactions With Venus -Theory and Computer Code

Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter

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Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter Nielsen Engineering & Research, Inc. Mountain View, California

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APPLICATION OF ADVANCED COMPUTATIONAL PROCEDURES FOR MODELING SOLAR-WIND INTERACTIONS WITH VENUS - THEORY AND COMPUTER CODE

by

Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter

SUMMARY

Advanced computational procedures are developed and applied to the prediction of solar-wind interaction with nonmagnetic terrestrial-planet atmospheres, with particular emphasis to Venus. The theoretical method is based on a single-fluid, steady, dissipationless, magnetohydrodynamic continuum model, and is appropriate for the calculation of axisymmetric, supersonic, super-Alfvénic solar-wind flow past terrestrial planets. The procedures, which consist of finite-difference codes to determine the gasdynamic properties and a variety of special-purpose codes to determine the frozen magnetic field, streamlines, contours, plots, etc. of the flow, are organized into one computational program which has been extensively documented and is presented in a general user's manual included as part of this report.

Theoretical results based upon these procedures are reported for a wide variety of solar-wind conditions and ionopause obstacle shapes. Plasma and magnetic-field comparisons in the ionosheath are also provided with actual spacecraft data obtained by the Pioneer-Venus Orbiter. These results have verified the appropriateness of the basic theoretical model, and have indicated the importance of accounting for the variable oncoming direction of the interplanetary solar wind.

INTRODUCTION

The magnetohydrodynamic models (refs. 1-9) of solar-wind interaction with planetary magneto/ionospheres and their associated calculations of the detailed flow and magnetic-field properties provide the basis of the theoretical understanding and interpretation of phenomena occurring in space around terrestrial planets from the viewpoint of a fluid rather than particle description of the flow. The general value and usefulness of results based on these models are now well established, and have advanced to the point where theoretical calculations can be used to predict important planetary and magnetic-field characteristics.

Prior to the previous work reported in reference 9, the utility of calculations based on these models was severely restricted due both to the fact that the original solution techniques employed bordered on what was barely possible at the time, as well as that considerable hand computation and intervention was required. Moreover, reported results were carried out for only a limited set of solar-wind conditions such as obstacle shape, oncoming Mach number, interplanetary magnetic field, etc., and were presented in archival publications only in the form of plots from which results for other conditions had to be determined by interpolation. The importance of the preliminary work of reference 9 was that advanced computational methods, based on current state-of-the-art algorithms, were introduced to this problem to provide the basic gasdynamic solutions. The frozen-in magnetic-field was then solved for on the high-resolution flow-field grid, and the entire computational procedure was assembled into a user-oriented program providing the detailed flow-field and magnetic-field properties in a convenient output format.

In the current work reported here, those basic procedures have been extended and generalized in several important directions. These include the capability for treating very low oncoming interplanetary gasdynamic Mach numbers ($M_{\infty} \simeq 2.0$), as well as quite general ionopause shapes. A new family of ionopause shapes has been developed which accounts for the effect of gravitational variation in scale height. Additionally, the capability for determining the plasma gasdynamic and magnetic-field properties along an arbitrary spacecraft trajectory, simultaneously accounting

for an arbitrary oncoming direction of the solar wind, has been developed. Moreover, a large number of sample calculations have been performed for typical solar-wind conditions and, using the output contour-plot capability, a catalog of these cases were established and are archived here for convenient quick-look use. Finally, a number of successful comparisons were made by the present computational model with actual space-craft observations obtained from initial orbits of the Pioneer-Venus Orbiter. These comparisons have both provided a verification of the basic theoretical model as well as demonstrated its value as a convenient research tool capable of routinely providing details of the solar-wind/planetary atmosphere interaction process not previously attainable—at modest computational cost and in a format directly compatible with observational data.

LIST OF SYMBOLS

```
speed of sound, (\gamma p/\rho)^{1/2}
а
                     Alfvén speed, (B^2/4\pi\rho)^{1/2}
Α
                     Jacobian matrix associated with IMP code, equal to \partial \hat{E}/\partial \hat{U}
Ā
В
                     magnetic field vector
\overline{\mathbf{B}}
                     Jacobian matrix associated with IMP code, equal to \partial \hat{F}/\partial \hat{U}
                     specific heat at constant pressure
                     specific heat at constant volume
C_{v}
D
                     distance defined by eq. (59)
                     internal energy, eq. (3)
е
                     total energy, eq. (44)
e<sub>t</sub>
E
                     column matrix defined by eq. (42)
Ê
                     column matrix associated with IMP code, equal to
                     (\xi_{\mathbf{T}}\mathbf{U} + \xi_{\mathbf{Y}}\mathbf{E} + \xi_{\mathbf{p}}\mathbf{F})/\mathbf{J}
F
                     column matrix defined by eq. (42)
Ê
                     column matrix associated with IMP code, equal to
                     (\eta_{\mathbf{T}}\mathbf{U} + \eta_{\mathbf{X}}\mathbf{E} + \eta_{\mathbf{P}}\mathbf{F})/\mathbf{J}
                    acceleration due to gravity
g
                    gravitational component, eq. (5)
g_k
                    column matrix defined by eq. (42)
G
h
                    enthalpy, eq. (47)
^{\rm h}{_{\sf t}}
                    total enthalpy, eq. (47)
                    local scale height of atmosphere, \overline{R}T/\overline{M}g
Η
                    local scale height with gravitational variation, H(R_p/R_s)^2
\overline{\mathbf{H}}
J
                    Jacobian matrix, eq. (43)
K
                    constant defined by eq. (34)
                    vector length of elemental magnetic flux tube
Δl
                    local Mach number, |y|/a
Μ
M
                    nondimensional mean molecular mass, equal to 1/2 for
                    ionized atomic hydrogen
```

LIST OF SYMBOLS (Continued)

M _A	local Alfven Mach number, $ v /A$
р	pressure
q	shock velocity
Q	dummy parameter
r	spherical radial distance
R	cylindrical radial distance
R	gas constant, 8.315 × 10 7 ergs/gm°K
R _i	spherical radius of ionopause, eq. (39)
R _O	spherical distance from center of planet to ionopause nose
s _k	Poynting vector component
ΔS	incremental distance along streamline
t,T	time
(u,v,w)	velocity components associated with the (X,Y,Z) coordinate directions, respectively
U	column matrix defined by eq. (42)
Û	column matrix associated with IMP code, equal to $\ensuremath{\mathtt{U}}/\ensuremath{\mathtt{J}}$
$\tilde{\Lambda}$	velocity vector
(x,y,z) or (x_w,y_w,z_w)	solar-wind oriented Cartesian coordinates with origin at planetary center, ${\bf x}$ positive upstream and ${\bf z}$ positive northward
(x_s, y_s, z_s)	sun-planet oriented Cartesian coordinates with origin at planetary center, x_s positive toward sun, y_s positive opposite to planetary orbital motion, and z_s positive northward
(x',y',z')	solar-wind oriented Cartesian coordinates defined by an azimuthal rotation given by eq. (70)
(X,Y,Z)	solar-wind oriented Cartesian coordinates with origin at planetary center, X positive downstream and Z positive northward
^α p	interplanetary magnetic-field angle between perpendicular and parallel components, eq. (62)
^α n	interplanetary magnetic-field angle between normal and in- plane components, eq. (63)

LIST OF SYMBOLS (Continued)

β	spherical polar angle, measured with origin at planet center, from subsolar point away from undisturbed solar wind direction; varies from 0 in upstream direction to π in downstream direction; eq. (39)
Υ	ratio of plasma specific heats
δ	angle defined by eq. (59)
$^{\delta}$ ik	Kronecker delta
δ _s	local angle of bow shock wave
$(\delta_{\xi}, \delta_{\eta})$	second-order difference operators in (,) direction
ε	smoothing coefficient in IMP code
η	transformation variable, eqs. (40), (48)
θ	azimuthal rotation angle in solar-wind (X,Y,Z) system, eq. (69); also shock tangency angle, eq. (59)
Λ	quantity defined by eq. (36)
ξ	transformation variable, eqs. (40), (48)
ρ	density
σ	conductivity
τ	transformed time, eq. (40)
Φ	gravitational potential, eq. (5)
$^{\varphi}\mathtt{p}$	solar-wind polar angle
ψ	angle between outward normal to magneto/ionosphere boundary and oncoming undisturbed solar wind, eq. (32); also, angle of magnetic component $(B/B_{\infty})_{\perp}$, eq. (58)
Subscripts	
b	obstacle body
i	ionopause
n	normal direction
P	arbitrary point
R	reference quantity
s	planetary surface; also streamline
s	shock surface

LIST OF SYMBOLS (Concluded)

st	stagnation conditions
t	tangential direction
0	reference quantity at subsolar point
1	conditions upstream of a discontinuity
2	conditions downstream of a discontinuity
∞	interplanetary undisturbed quantity
(", ±, n)	parallel, perpendicular, and normal magnetic-field components as defined in eq. (56)
Superscripts	

unit vector

relative to shock

ANALYSIS

The Mathematical Model - Formulation of the Fluid Representation

The fundamental assumption underlying the present work and that reported in all of the references cited above is that the average bulk properties of solar-wind flow around a planetary magneto/ionosphere can be adequately described by the continuum equations of magnetohydrodynamics for a single-component perfect gas having infinite electrical conductivity and zero viscosity and thermal conductivity. Theoretical justification of this point has not yet been established, and proof remains essentially qualitative at present. The primary justification for use of the continuum fluid model is the outstanding agreement of the qualitative results predicted on this basis with those actually measured in space. It appears that the continuum model is capable of accounting both for many of the details as well as the broad features of the observations.

Governing equations. - The equations which express the conservation of the average bulk mass, momentum, energy, and magnetic field of the solar-wind plasma are given by the following expressions:

$$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x_k} (\rho v_k) = 0$$
 (1)

$$\frac{\partial}{\partial t} (\rho v_i) + \frac{\partial}{\partial x_k} \left[\rho v_i v_k + p \delta_{ik} - \frac{B_i B_k}{4\pi} + \frac{B^2}{8\pi} \delta_{ik} + \frac{g_i g_k}{4\pi G} - \frac{g^2}{8\pi G} \delta_{ik} \right] = 0$$
(2)

$$\frac{\partial}{\partial t} \left[\frac{\rho \mathbf{v}^2}{2} + \rho \mathbf{e} + \rho \Phi + \frac{\mathbf{B}^2}{8\pi} \right] + \frac{\partial}{\partial \mathbf{x}_k} \left[\rho \mathbf{v}_k \left[\frac{\mathbf{v}^2}{2} + \mathbf{e} + \frac{\mathbf{p}}{\rho} + \Phi \right] + \mathbf{S}_k \right] = 0$$
(3)

$$\frac{\partial B_{\dot{\mathbf{1}}}}{\partial t} = \frac{\partial}{\partial x_{\mathbf{k}}} \left(v_{\dot{\mathbf{1}}} B_{\mathbf{k}} - v_{\mathbf{k}} B_{\dot{\mathbf{1}}} \right) , \frac{\partial B_{\dot{\mathbf{1}}}}{\partial x_{\dot{\mathbf{1}}}} = 0$$
 (4)

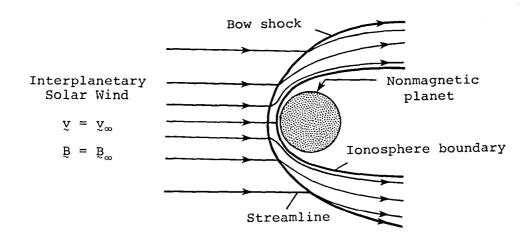
where

$$g_{i} = -\frac{\partial \Phi}{\partial x_{i}} , S_{k} = \frac{1}{4\pi} \left(v_{k} B^{2} - B_{k} v_{i} B_{i} \right)$$
 (5)

and the equation of state of a perfect gas is given by

$$p = \frac{\rho \overline{R} T}{\overline{M}} \tag{6}$$

In these equations and those to follow, the symbols ρ , ρ , ν , T, $e = C_V T$, and $h = C_p T$ refer to the density, pressure, velocity, temperature, internal energy and enthalpy, and C_V and C_p refer to the specific heats at constant volume and pressure. We define the symbol $\overline{R} = (C_p - C_V) \overline{M} = 8.31 \times 10^7 \, \text{ergs/gm}^{\circ} \, \text{K}$ as the universal gas constant, and \overline{M} as the mean molecular weight nondimensionalized so that $\overline{M} = 16$ for atomic oxygen. For fully ionized hydrogen, \overline{M} is thus 1/2. The magnetic field \overline{B} and the Poynting vector \overline{S} for the flux of electromagnetic energy are expressed in terms of gaussian units. The gravitational potential Φ and acceleration \overline{g} are assumed to be due to massive fixed bodies so that their time derivatives are zero. These equations apply in the region exterior to the ionosphere boundary, as shown in the sketch below, and also in a degenerate sense in the ionosphere.



Conditions at discontinuities.— Because of the omission of dissipative terms in these equations, surfaces of discontinuity may develop in the solution, across which the fluid and magnetic properties change abruptly, but in such a way that mass, momentum, magnetic flux, and energy are conserved. These are approximations to comparatively thin surfaces across which similar but continuous changes in the fluid and magnetic properties occur in the corresponding theory of a dissipative gas, and correspond physically to the bow wave, ionosphere boundary, and possibly other thin regions of rapidly changing properties. Across these surfaces, continuous solutions of the dissipationless differential equations cease to exist. The flow is no longer governed solely by the differential equations (1) to (4), but must be supplemented by additional considerations. The conservation of mass, momentum, magnetic flux, and energy lead to the following conditions which relate quantities on the two sides of any such discontinuity:

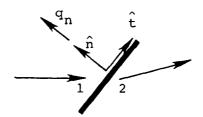
$$\left[\rho \mathbf{v}_{\mathbf{n}}^{\star}\right] = 0 \tag{7}$$

$$\left[\rho \tilde{y} \cdot v_{n}^{*} + (p + B^{2}/8\pi) \hat{n} - B_{n} \tilde{B}_{t}/4\pi\right] = 0$$
 (8)

$$\begin{bmatrix} B_{t} \cdot v_{n}^{*} - B_{n} \cdot v_{t} \end{bmatrix} = 0 \tag{9}$$

$$\left[v_{n}^{\star}\left[\frac{1}{2}\rho v^{2} + \rho e + p + \frac{B^{2}}{4\pi}\right] + q_{n} \cdot \left[p + \frac{B^{2}}{8\pi}\right] - \frac{B_{n}(v \cdot B)}{4\pi}\right] = 0$$
 (10)

Here, (\hat{n}, \hat{t}) denote unit vectors normal and tangential to the discontinuity surface, as sketched below,



where q_n represents the local normal velocity of the discontinuity surface, and $v_n^* = v_n - q_n$ is the fluid normal velocity component relative to the normal velocity q_n of the discontinuity surface. The square brackets are used to indicate the difference between the enclosed quantities on the two sides of the discontinuity, as in $[Q] = Q_2 - Q_1$ where subscripts 1 and 2 refer to conditions on the upstream and downstream sides, respectively, of the discontinuity.

Five classes of discontinuities are described by Eqs. (7-10). Those with $v_n^*=0$ are called tangential discontinuities or contact discontinuities according to whether or not B_n vanishes. Discontinuities across which there is flow $(v_n^*\neq 0)$ are divided into three categories called rotational discontinuities, and fast and slow shock waves. Some properties which distinguish the various discontinuities are indicated by the following relationships:

Tangential:

$$v_n^* = B_n = 0, [v_t] \neq 0, [B_t] \neq 0, [\rho] \neq 0, [p + B^2/8\pi] = 0$$
 (11)

Contact:

$$v_n^* = 0, B_n \neq 0, [v] = [B] = [p] = 0, [\rho] \neq 0$$
 (12)

Rotational:

$$v_n^* = \pm B_n / \sqrt{4\pi\rho}$$
, $[v_t] = \pm [B_t] / \sqrt{4\pi\rho}$
 $[\rho] = [p] = [v_n] = [v^2] = [B^2] = [B_n] = 0$
(13)

Fast and Slow Shock Waves:

$$\mathbf{v}_{\mathbf{n}}^{\star} \neq 0$$
, $[\rho] > 0$, $[\mathbf{p}] > 0$, $[\mathbf{B}_{\mathbf{n}}] = 0$

$$\left[\rho \mathbf{v}_{\mathbf{n}}^{\star}\right]_{\mathsf{fast}} \geq \left[\rho \mathbf{v}_{\mathbf{n}}^{\star}\right]_{\mathsf{rot}} \geq \left[\rho \mathbf{v}_{\mathbf{n}}^{\star}\right]_{\mathsf{slow}} \tag{14}$$

$${\tt B}_{\tt t}$$
 and ${\tt B}^2$ (increase) through (fast) shock waves

Of the five classes of discontinuities possible, two of these, the fast shock wave and the tangential discontinuity, are of concern in the present applications. The first relates conditions on the two sides of the bow shock wave, and any other shock waves present, while the latter has properties required to describe a boundary surface (ionopause) that separates the flowing solar wind and the planetary ionosphere. More detailed consideration of the tangential discontinuity condition leads to a determination of the ionopause shape, as described in the following sections.

With regard to conditions at the bow wave, for solar-wind flows past Venus, as well as Mars and the Earth, that discontinuity can only be represented by a fast shock wave since the mass flux through each of the other possible choices is too small. With regard to conditions at the ionopause, of the various possibilities, only the tangential discontinuity has properties compatible with those required to describe a boundary surface that separates the externally flowing solar wind and the planetary atmosphere; that is, the condition $\mathbf{v}_n^* = \mathbf{0}$ prohibits flow across the boundary, while the condition $\mathbf{B}_n = \mathbf{0}$ must hold since by assumption no magnetic field exists interior to the ionopause and the solenoidal jump condition $[\mathbf{B}_n] = \mathbf{0}$ always holds.

Frozen-field approximation. Two important parameters characterize the solar-wind flow at any field point as described by eqs. (1-5). These are the Mach number M = v/a and the Alfvén Mach number M_A = v/A. The former is the ratio of the flow velocity to the speed of sound a = $(\gamma p/\rho)^{\frac{1}{2}}$, while the latter is the ratio of the flow velocity to the speed A =

 $(B^2/4\pi\rho)^{\frac{1}{2}}$ of a rotational or Alfvén wave propagating along the direction of the magnetic field.

For typical solar-wind conditions (refs. 5,6), both the oncoming Mach number and the Alfvén Mach number are high $(M_{\infty} \simeq M_{\Lambda} \simeq 0(10))$. In this instance, an important simplification of the magnetohydrodynamic equations occurs. This is so because the order of magnitude of the inertia term in differential equation (2) for the momentum is related to that of the magnetic terms by the square of the Alfvén Mach number. When the latter is large, therefore, the magnetic terms in eqs. (2),(3),(8), and (10) decouple from the gasdynamic portions of those equations. Furthermore, for Earth, Venus, or Mars, the strong interactive nature of the flow permits the terms involving g and $\boldsymbol{\Phi}$ to be disregarded because of the relative smallness of their effect on the fluid motion (ref. 5). The equations for the fluid motion thereby reduce to those of gasdynamics, while the magnetic field B can be determined subsequently by solving the remaining equations using the values for y already determined. The magnetic field, determined in this fashion, is usually interpreted as being "frozen-in" or moving with the fluid (ref. 5).

This then results in the following differential and conservation equations; for the flow field

$$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x_k} (\rho v_k) = 0$$
 (15)

$$\frac{\partial}{\partial t} (\rho v_i) + \frac{\partial}{\partial x_k} (\rho v_i v_k + p \delta_{ik}) = 0$$
 (16)

$$\frac{\partial}{\partial t} \left[\frac{\rho v^2}{2} + \rho e \right] + \frac{\partial}{\partial x_k} \left[\rho v_k \left[\frac{v^2}{2} + e + p/\rho \right] \right] = 0$$
 (17)

$$\left[\rho v_{n}^{\star}\right] = 0 \tag{18}$$

$$\left[\rho \overset{\mathbf{v}}{\mathbf{v}} \cdot \overset{\mathbf{v}}{\mathbf{v}} + p\right] = 0 \tag{19}$$

$$\left[\mathbf{v}_{\mathbf{n}}^{\star} \cdot \left(\frac{1}{2} \rho \mathbf{v}^{2} + \rho \mathbf{e} + \mathbf{p}\right)\right] = 0 \tag{20}$$

and for the magnetic field

$$\frac{\partial B_{i}}{\partial t} + \frac{\partial}{\partial x_{k}} (v_{k}B_{i} - v_{i}B_{k}) = 0$$
 (21)

$$\frac{\partial B_{i}}{\partial x_{i}} = 0 \tag{22}$$

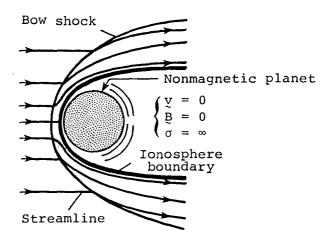
$$\left[B_{n}\right] = 0 \tag{23}$$

$$\left[\mathbf{B}_{\mathbf{n}} \cdot \mathbf{y}_{\mathbf{t}} - \mathbf{B}_{\mathbf{t}} \cdot \mathbf{v}_{\mathbf{n}}^{\star}\right] = 0 \tag{24}$$

Equations (15) to (24) provide the governing equations which form the basis of the mathematical representation of the solar wind-magneto/ionosphere interaction problem considered here. For all of the results as well as the computer codes presented herein, we are interested exclusively in the steady-state solution to these equations which are obtained by setting $\partial/\partial t = 0$ and $v_n^* = v_n$, i.e. $q_n = 0$. We have presented the unsteady equations, however, since one of the computational methods used to determine the gasdynamic solution employs an unsteady procedure, integrating in time until the steady-state solution is asymptotically obtained.

Determination of the Ionosphere Boundary

The determination of the ionosphere boundary initiates from the assumptions that the ionosphere, or at least the outer part of it that participates in the interaction with the solar wind, is idealized as a spherically-symmetric and hydrostatically-supported plasma having infinite electrical conductivity, effectively bound to the planet and incapable of mixing with the solar wind, as indicated in the sketch below:



This interior plasma is separated from the flowing solar plasma by a tangential discontinuity across which the relations

$$v_n = B_n = [p + B^2/8\pi] = 0$$
 (25) $[v_t] \neq 0; [B_t] \neq 0; [\rho] \neq 0$

given previously (eq. (11)) must hold. The basis for important simplifying approximations to these conditions, which can be assumed to apply at the Venusian ionosphere boundary and possibly for that at Mars as well, is that the gas pressure p is much larger than the magnetic pressure $B^2/8\pi$ on both sides of the ionopause. Therefore, the discontinuity pressure balance relation $[p+B^2/8\pi]=0$ of eq. (25) reduces to a simple equality between the ionosphere pressure and the static pressure of the flowing solar plasma adjacent to the ionopause, i.e.

$$(p)_{atm.} = (p)_{flow}$$
 (26)

Determination of the ionospheric pressure in the vicinity of the ionopause for the ionosphere models chosen in this study proceeds from the assumption of hydrostatic support, which implies a quiescent ionosphere where the bulk motions of the gas with respect to the planet are sufficiently small (v = 0) that equilibrium exists between the pressure gradient and gravity, viz.

$$dp/dr = -\rho g \tag{27}$$

where p and ρ are the gas pressure and density, r is the radial distance measured from the center of the planet, and g is the acceleration due to gravity. The variation of g is inversely proportional to r_s , so that $g = g_s(r_s/r)^2$ where the subscript s denotes values at the surface of the planet. Since the density ρ is related to the pressure according to the perfect gas law eq. (6), eq. (27) can be integrated to yield

$$p = p_{R} \exp \left(-\int_{R_{R}}^{r} \frac{dr}{H}\right)$$
 (28)

where p_R is the pressure at some reference radius R_R and H is the local scale height of the atmosphere given by H = $\overline{R}T/\overline{M}g$.

If H is regarded as constant; that is, if variations of g and T with r are neglected, eq. (27) can be integrated directly to yield

$$p = p_{R} \exp \left(-\frac{r - R_{R}}{H}\right) \tag{29}$$

In view of uncertainties associated with measurements of the atmospheric properties of Venus and Mars, the variation of p with r as given by eq. (29) was adopted in the initial solar wind/ionosphere applications (ref. 6) and was also used in the previous study (ref. 9) involving the initial application of advanced computational methods to this problem. With preliminary ionospheric data now available from the Pioneer-Venus spacecraft (refs. 10 and 11), some of these uncertainties for Venus have been removed. It has been found that the assumption of an isothermal (T = constant) atmosphere at typical ionopause heights is quite reasonable. Consequently, there is no need to neglect the variation of gravity in the scale height in eq. (28). Including this effect leads to the following result for the pressure

$$p = p_{R} \exp \left[-\frac{R_{R} \cdot (r - R_{R})}{\overline{H} \cdot r} \right]$$
 (30)

where

$$\overline{H} = H_{s} \cdot (R_{R}/R_{s})^{2} \tag{31}$$

and R_s is the planetary radius and $H_s = \overline{R}T/\overline{M}g_s$. Equations (29) and (30) provide the two models employed in this study for the ionosphere pressure variation which is required in eq. (26) for the pressure balance condition at the ionopause.

For the a priori determination of the static pressure of the flowing solar-wind plasma on the exterior boundary of the ionosphere - $(p)_{flow}$ in eq. (26) - we use, as in all previous applications, the Newtonian approximation

$$p = p_{st} \cos^2 \psi \tag{32}$$

where ψ is the angle between the outward normal to the magnetosphere boundary and the flow direction of the oncoming undisturbed solar wind, and $p_{\mbox{st}}$ is the stagnation or ram pressure exerted on the nose of the ionopause and is given by

$$p_{st} = K \rho_{\infty} v_{\infty}^2$$
 (33)

In this relation, K is a constant usually taken as one, but whose actual value is $\frac{1}{2}$

$$K = \frac{1}{\gamma} \left[\frac{(\gamma + 1)/2}{(\gamma - (\gamma - 1)/2M_{\infty}^{2})} \right]^{\frac{1}{\gamma - 1}}$$
(34)

For the high Mach number flows typical of solar-wind conditions, K approaches 0.844 for γ = 2 and 0.881 for γ = 5/3. Modification of the product $K\rho_{\infty}$ in eq. (33) to account for the presence of minor constituents such as ionized helium in the solar wind, as well as a discussion of the differences in that product between a fluid and collisionless representative, is provided in reference 8. The important implication associated with the introduction of the Newtonian approximation is that the calculation of the shape of the ionosphere boundary decouples from the calcula-

tion of the external flow. We then arrive at the following equation for the pressure balance at the ionopause locations R_i :

$$K\rho_{\infty}v_{\infty}^{2}\cos^{2}\psi = p_{R}\Lambda(R_{i}) \qquad (35)$$

where

$$\Lambda(R_{i}) = \begin{cases} \exp\left[-\left(\frac{R_{i} - R_{R}}{H}\right)\right] & g,T = \text{Const.} \end{cases}$$

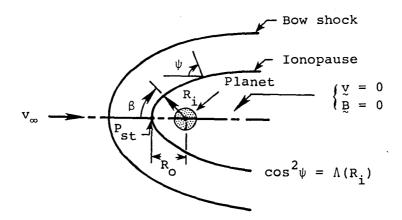
$$\exp\left[-R_{R}\left(\frac{R_{i} - R_{R}}{\overline{H} \cdot R_{i}}\right)\right] \end{cases} g,T = Const.$$

$$(36a)$$

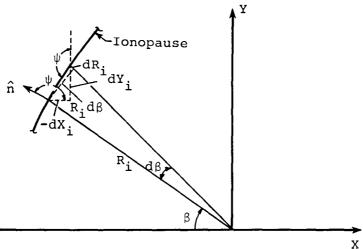
depending upon whether the gravitational variation is included in scale height or not. It is convenient to choose as the reference radius and location the stagnation point on the ionopause; that is, $R_R=R_O$ where R_O is the distance from the center of the planet to the nose of the ionopause. This implies that $p_R=p_O=K\rho_\infty v_\infty^2$ and that at all points along the ionosphere boundary

$$\cos^2 \psi = \Lambda(R_i) \tag{37}$$

The final mathematical statement of the free-boundary problem for determining the shape of the ionosphere boundary then is summarized in the sketch below:



In order to proceed to a final determination of the ionopause shape, it is necessary to relate the local angle ψ to the local coordinates (R_i, β) of the boundary. This is accomplished with the help of the following sketch



from which we find

$$\cos^2 \psi = \left[\frac{dY_i}{dS}\right]^2 = \frac{\left(R_i d\beta \cos \beta + dR_i \sin \beta\right)^2}{dR_i^2 + \left(R_i d\beta\right)^2}$$
(38)

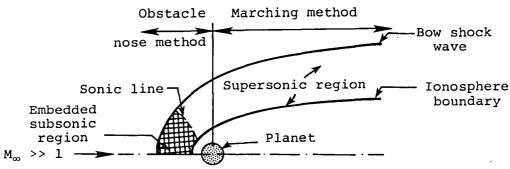
This results in the following ordinary differential equation for the ordinates of the ionosphere boundary

$$\frac{dR_{i}}{d\beta} = R_{i} \left[\frac{\sin 2 \beta - 2 \sqrt{\Lambda - \Lambda^{2}}}{2(\Lambda - \sin^{2} \beta)} \right] \quad 0 \leq \beta \leq \pi$$
 (39)

where Λ is defined by eqs. (36a,b) and β is the angle measured from the subsolar point as indicated above. Results for various ionopause shapes obtained by integrating eq. (39) for different values of H/R_O using the constant scale-height model eq. (36a) were provided in ref. 9. Similar results using the isothermal model, eq. (36b) for different values of \overline{H}/R_O in the range $0.01 \leq \overline{H}/R_O \leq 0.5$ are provided in figure 1, where for comparison purposes the constant scale-height shapes for corresponding H/R_O values are also illustrated. We note that the range of interest for planetary applications to Venus and Mars appears to be $0.01 \lesssim \overline{H}/R_O \lesssim 0.10$. Tabulated ordinates of Y_1/R_O vs. X/R_O are provided in Table 1 for $\overline{H}/R_O = 0.01$, 0.05, 0.10, 0.20, and 0.25, where $Y_1 = R_1 \sin \beta$ is the cylindrical radial coordinate of the ionopause profile.

Calculation of the Gasdynamic Flow Properties

Determination of the gasdynamic flow properties is, both conceptually and computationally, the most difficult and time-consuming portion of the total calculation of the solar-wind/terrestrial-planet interaction; and represents the heart of the present modeling effort insofar as the application of advanced computational procedures is concerned. The calculation consists of determining solutions to the differential equations and discontinuity conservation equations given by eqs. (15-20). Since in solar-wind/terrestrial-planet interactions, both the downstream tail region (far field) as well as the region in the vicinity of the obstacle nose (near field) are generally of interest, the computational methods selected must be capable of efficiently determining this entire flow field. In view of the need to carry the flow calculation to an arbitrary downstream distance, the most computationally-expedient procedure is to subdivide the flow field into two regions, as indicated in the sketch below:



This sketch illustrates the essential features of the high-supersonic Mach number flow typical of solar-wind flows past terrestrial planets. Of particular note is the embedded subsonic pocket located at the nose of the ionopause. The presence of this subsonic pocket necessitates use of a computational method capable of treating mixed subsonic/supersonic flows. Downstream of this region, the flow becomes supersonic and remains so for the convex shapes typical of solar-wind/ionosphere bound-aries. In that region, a more computationally-economical procedure than that required near the nose can be employed. Such a subdivision of both flow field and solution procedures is common practice for calculating such flows and was employed in the previous solar-wind applications as well as in a related application to space shuttle reentry flows (ref. 12). The precise surface on which the solutions are joined is relatively

arbitrary; in our procedure it was convenient to place it along a plane through the planet center and normal to the free-stream direction of the solar wind, i.e. the dawn-dusk terminator. As illustrated in fig. 2, this position is further downstream than used in the former work in which an inverse iteration method was used for the nose region and the method of characteristics was used for the remaining supersonic region. In light of recent advances, both of the techniques used in the former procedures, particularly the inverse method, are now considered obsolete and much inferior to more current methods. In the new code, those two methods have been superceded by: (1) a new axisymmetric implicit unsteady Euler-equation solver (IMP) specifically developed for the present application, which determines the steady-state solution in the nose region by an asymptotic time-marching procedure, and (2) a shock-capturing marching solution (SCT) which spatially advances the solution downstream as far as required by solving the steady Euler equations.

Nose region solution - implicit unsteady Euler equation method. - The partial differential equations employed in the implicit (IMP) code are the unsteady gasdynamic Euler eqs. (15-20) for axisymmetric flow. These equations may be written in conservation-law form under the generalized independent variable transformation

$$\tau = T, \quad \xi = \xi(T, X, R), \quad \eta = \eta(T, X, R) \tag{40}$$

as follows

$$(U/J)_{\tau} + \left[(\xi_{T}U + \xi_{X}E + \xi_{R}F)/J \right]_{\xi} + \left[(\eta_{T}U + \eta_{X}E + \eta_{R}F)/J \right]_{\eta} + G = 0$$
where
$$U = \begin{bmatrix} \rho \\ \rho u \\ \rho v \\ \rho e_{t} \end{bmatrix} \qquad E = \begin{bmatrix} \rho u \\ p + \rho u^{2} \\ \rho uv \\ (\rho e_{t} + p)u \end{bmatrix}$$

$$(41)$$

$$F = \begin{bmatrix} \rho v \\ \rho u v \\ p + \rho v^{2} \\ (\rho e_{t} + p) v \end{bmatrix} \qquad G = \frac{1}{RJ} \begin{bmatrix} \rho v \\ \rho u v \\ \rho v^{2} \\ (\rho e_{t} + p) v \end{bmatrix}$$

and the Jacobian

$$J = \xi_X \eta_R - \xi_R \eta_X \tag{43}$$

In eqs. (40) through (43), T denotes time, X is the axial downstream coordinate, and R the cylindrical radial distance; u and v the velocity components in the X and R directions; and e_t is the total energy per unit mass, which for a perfect gas is related to the other quantities by

$$e_{+} = p/[\rho(\gamma - 1)] + (u^{2} + v^{2})/2$$
 (44)

The subscripts in eqs. (41) and (43) denote partial derivatives with respect to the indicated variable.

The analysis commences by introducing a computational mesh in polar (r,β) coordinates such that one family of coordinates consists of rays from the planetary center spaced at equal increments of β measured from the obstacle nose, and the other of curved lines intersecting each ray so as to divide the portion of it between the ionopause and the shock wave into a fixed number of equal segments. The coordinate transformation eq. (40) is then used to map the portion of the X,R,T physical space bounded by (1) the bow wave, (2) the downstream outflow boundary at $\beta=\pi/2$, (3) the obstacle surface, and (4) the stagnation streamline at $\beta=0$ into a rectangle in the ξ,η,τ computational space as illustrated in fig. 3. Generally, the transformation metrics at each time step are not known beforehand, and must be determined numerically as part of the solution. Integration step size is established by using the eigenvalues of the Jacobian matrices \overline{A} and \overline{B} , where $\overline{A}=\partial \widehat{E}/\partial \widehat{U}$, $\overline{B}=\partial \widehat{F}/\partial \widehat{U}$, and $\widehat{U}=U/J$, $\widehat{E}=(\xi_TU+\xi_XE+\xi_RF)/J$, and $\widehat{F}=(\eta_TU+\eta_XE+\eta_RF)/J$.

Boundary conditions necessary for the specification of a properly-posed mathematical problem are that the flow (a) satisfy the axisymmetric Rankine-Hugoniot shock relations derivable from eq. (41) along (1), (b) be entirely supersonic along (2), (c) be parallel to boundaries (3) and (4), and (d) be symmetric about boundary (4). Initial flow-field conditions are determined by use of an approximating formula for the coordinates of the bow shock wave which is dependent on γ , M_{∞} and the shape of the obstacle, and by prescribing a Newtonian pressure

distribution on the obstacle. Since the maximum entropy streamline wets the obstacle surface, that fact plus the known flow direction on the obstacle serve to determine the remainder of the flow properties on that surface. A linear variation for the flow properties between the bow shock and the obstacle is then prescribed. This provides the initial flow field which is then integrated in a time-asymptotic fashion until the steady-state solution is obtained.

The basic numerical algorithm used in the IMP code was developed by Beam and Warming (ref. 13) and is second-order accurate, noniterative, and spatially factored. In particular, the "delta form" with Euler time differencing is employed. When applied to eq. (41), the algorithm assumes the form

$$(\mathbf{I} + \Delta \tau \delta_{\xi} \overline{\mathbf{A}}^{n}) (\mathbf{I} + \Delta \tau \delta_{\eta} \overline{\mathbf{B}}^{n}) (\hat{\mathbf{U}}^{n+1} - \hat{\mathbf{U}}^{n}) = -\Delta \tau (\delta_{\xi} \hat{\mathbf{E}}^{n} + \delta_{\eta} \hat{\mathbf{F}}^{n} + \mathbf{G})$$
 (45)

where \overline{A} and \overline{B} are the Jacobian matrices, I is the identity matrix, δ_{ξ} and δ_{η} are second-order, central-difference operators, $\hat{U}^{n+1} = \hat{U}(n\Delta\tau)$ and $\Delta\tau$ is the integration step size.

Equation (45) is solved at the interior points only. It requires two 4x4 block tridiagonal inversions at each time step of the integration. The solution proceeds as follows:

- 1. Define $\Delta \hat{\mathbf{U}} = \hat{\mathbf{U}}^{n+1} \hat{\mathbf{U}}^n$
- 2. Form the right-hand side of eq. (45) and store results in the $\hat{\mathbb{U}}^{n+1}$ array.
- 3. Apply smoothing $\hat{\mathbf{U}}^{n+1} = \hat{\mathbf{U}}^{n+1} (\varepsilon/8)S/J$.
- 4. Define $\overline{U}=(I+\Delta\tau\delta_{\eta}\overline{B}^n)\Delta\hat{U}$ and solve the matrix equation $(I+\Delta\tau\delta_{\xi}\overline{A}^n)\overline{U}=\hat{U}^{n+1}$ for \overline{U} storing the result in the \hat{U}^{n+1} array.
- 5. Solve the matrix equation (I + $\Delta \tau \delta_n \overline{B}^n$) $\Delta \hat{U} = \hat{U}^{n+1}$ for $\Delta \hat{U}$.
- 6. Obtain the values of $\hat{\mathbf{U}}^{n+1}$ from the relation $\hat{\mathbf{U}}^{n+1} = \Delta \hat{\mathbf{U}} + \hat{\mathbf{U}}^n$.

7. Transfer contents of \hat{U}^{n+1} to \hat{U}^n and repeat all steps until satisfactory convergence is attained.

In step 3 a fourth-order smoothing term S is used to eliminate nonlinear instabilities that may arise since the use of central differences in the spatial directions results in a neutrally stable algorithm. This smoothing term is given by

$$s_{jk} = (\hat{\mathbf{U}}_{J})_{j+2,k}^{n+1} - 4 \left[(\hat{\mathbf{U}}_{J})_{j+1,k}^{n+1} + (\hat{\mathbf{U}}_{J})_{j-1,k}^{n+1} \right] + 12 (\hat{\mathbf{U}}_{J})_{j,k}^{n+1} + (\hat{\mathbf{U}}_{J})_{j-2,k}^{n+1}$$

$$+ (\hat{\mathbf{U}}_{J})_{j,k+2}^{n+1} - 4 \left[(\hat{\mathbf{U}}_{J})_{j,k+1}^{n+1} + (\hat{\mathbf{U}}_{J})_{j,k-1}^{n+1} \right] + (\hat{\mathbf{U}}_{J})_{j,k-2}^{n+1}$$

$$(46)$$

and ϵ , the smoothing coefficient, chosen from the range $0 \le \epsilon \le 0.4$ depending upon the size of the time step. The j and k indices correspond to the ξ and η directions, respectively. At the points adjacent to the boundaries a special form of the smoothing term is used.

At the boundaries, modification of the differencing algorithm to account for the particular conditions described above is accomplished as follows. The obstacle-surface flow-tangency condition is incorporated through the use of Kentzer's scheme (ref. 14), while at the symmetry plane, the variables are reflected according to whether they are odd or even. At the outflow boundary where the flow is entirely supersonic, the dependent variables are determined by extrapolation from the adjacent interior points. For the upstream boundary formed by the bow shock wave, the sharp discontinuity approach of reference 15 is used. The interior flow field bounded by these various boundaries is treated in shock—capturing fashion and, therefore, allows for the correct formation of secondary internal shocks.

In the initial development of the nose-region solution procedure (ref. 9), it was found that for certain ionopause obstacle shapes which have a significant amount of lateral flaring at the dawn-dusk terminator, for example, constant scale-height shapes for $\mathrm{H/R}_{\mathrm{O}} \geq 0.5$, and/or cases involving low free-stream Mach numbers $\mathrm{M}_{\infty} \leq 3$, the axial component of velocity at some points on the terminator plane $\beta = \pi/2$ may become

subsonic. Although this has no effect whatsoever on the nose-region solver, for these cases the downstream solution cannot be obtained since the marching-region solver which determines the solution downstream of this starting plane, and which is described in detail in the following section, requires supersonic axial velocities in order to proceed. Under the work reported here, this limitation has been removed by developing the capability for adding an additional portion of the flow field, located downstream of the terminator, to the blunt-body solution as illustrated in figure 4. This effectively generalizes the capability of the present procedures to treat a wide variety of ionopause shapes including all of the shapes of interest described by the constant scale-height and scale-height with gravitational variation atmospheric models found from eqs. (36a,b) - as well as to treat relatively low free-stream Mach numbers, $M_m \simeq 2.0$. Details of this capability are provided in the Computer Program Users Manual, Section A.2.1.1 of this report.

Downstream region solution - shock capturing marching method.- Since the shock-capturing technique employed has been described previously in references 16-18, only an outline of the salient features is provided here. The analysis is based on the conservation-law form of the gasdynamic Euler equations for steady axisymmetric flow, which can be readily obtained from eqs. (40) through (44) by setting the τ derivatives to zero. The fourth of this set of equations representing conservation of energy ρe_t can be integrated for steady flow to yield the following relation for the total enthalpy

$$h_t = h + (u^2 + v^2)/2 = constant$$
 (47)

where $h = e + p/\rho = C_pT$ is the enthalpy per unit mass.

The computational mesh is defined by lines of constant X and $(R-R_b)/(R_s-R_b)$, where R_s and R_b are functions of X that describe the radial cylindrical coordinates of the ionopause and bow shock wave at the same X as the field point (X,R). The three remaining partial differential equations for conservation of mass and of axial and radial momentum are then transformed to a rectangular computational space by the transformation

$$\xi = X, \quad \eta = \frac{R - R_b}{(R_s - R_b)}$$
 (48)

to obtain

$$\partial \tilde{E}/\partial \xi + \partial \tilde{F}/\partial \eta + \tilde{G} = 0$$
 (49)

$$\tilde{E} = E, \quad \tilde{F} = \left\{ F - \left[\frac{\partial}{\partial \xi} R_b + \eta \frac{\partial}{\partial \xi} (R_s - R_b) \right] \right\} / (R_s - R_b)$$

$$\tilde{G} = G + \frac{E}{R_s - R_b} \frac{\partial}{\partial \xi} (R_s - R_b)$$
(50)

The finite-difference counterpart of eq. (49) is integrated with respect to the hyperbolic coordinate ξ to yield values of the conservative variable E. Subsequent to each integration step, the physical flow variables p, p, u, and v must be decoded from the components e_i of E. This necessitates the solution of four simultaneous, nonlinear equations consisting of eq. (47) together with the three elements e_i . This can be done readily by using the relations $v = e_3/e_1$, $p = e_2 - e_1u$, and $\rho = e_1/u$ together with the expression $h = \gamma/(\gamma-1)(p/\rho)$ for a perfect gas to determine the following quadratic equation for u

$$\frac{u^{2}}{2} + \frac{\gamma}{\gamma - 1} \left(\frac{e_{2} - e_{1}u}{e_{1}} \right) u - h_{t} + \left(\frac{e_{3}}{e_{1}} \right)^{2}$$

$$= -\frac{\gamma + 1}{2(\gamma - 1)} u^{2} + \left(\frac{\gamma}{\gamma - 1} \right) \frac{e_{2}}{e_{1}} u - h_{t} + \left(\frac{e_{3}}{e_{1}} \right)^{2} = 0$$
 (51)

Two roots exist; one corresponds to subsonic flow and is discarded since u is always supersonic in the present application, while the other corresponds to supersonic flow and gives the desired solution.

Since only the bow shock wave is treated as a sharp discontinuity and any others that may be present are "captured" by the difference algorithm, selection of the appropriate finite difference scheme to advance the calculation in the ξ direction is of prime importance. Following the analysis of refs. 16-18, the numerical integration of eq. (49) is accomplished using the finite-difference predictor-corrector

scheme of MacCormack (ref. 19), the most efficient second-order algorithm for shock-capturing calculations. General descriptions of the method can be found in the references cited.

Calculation of the streamlines.— The streamlines are determined by integrating fluid particle trajectories through the known velocity field since this procedure was found to be more accurate than the alternative mass-flow calculation. The calculation of a particular streamline is initiated at the point where the streamline crosses the bow shock, as illustrated in figure 5. At that point, exact values of the streamline slope $dR_{\rm S}/dX$ are known in terms of the local shock angle $\delta_{\rm S}$ and free-stream quantities according to the relation

$$\frac{dR_{S}}{dX} = \frac{(2\cot \delta_{S}) (M_{\infty}^{2} \sin^{2} \delta_{S} - 1)}{2 + M_{\infty}^{2} (\gamma + 1 - 2\sin^{2} \delta_{S})}$$
(52)

which is contained implicitly in both the blunt-body (IMP) and marching (SCT) code solutions. At other points in the flow field, the local stream-line slope is given by the ratio of radial to downstream velocity, i.e.,

$$dR_{S}/dX = v/u (53)$$

and the streamline determination is made by stepwise integration in X using a modified third-order Euler predictor-corrector method. Bivariate linear interpolation from the flow-field grid points is employed to obtained the velocity components (u,v) required at the stepwise points along the streamline trajectory. Separate streamline calculations are made for the nose region (IMP results) and downstream region (SCT results) because of the different coordinate systems employed in those two regions.

Calculation of the Magnetic Field

With the flow properties known from the gasdynamic calculations, determination of the steady magnetic field B proceeds by integrating the

remaining magnetohydrodynamic equations not employed in the gasdynamic analysis, that is eqs. (21-24) with $\partial/\partial t = 0$:

$$\operatorname{curl} (B \times v) = 0, \quad \operatorname{div} B = 0$$

$$[B_{n}v_{t} - B_{t}v_{n}] = 0, \quad [B_{n}] = 0$$
(54)

These equations are commonly interpreted as indicating the field lines move with the fluid. The analysis associated with eqs. (54) leads to a straightforward calculation in which the vector distance from each point on an arbitrarily-selected field line to its corresponding point on an adjacent field line in the downstream direction is determined by numerically integrating $\int \mathbf{v} \ dt$ over a fixed time interval Δt . Once the coordinates of the field lines are determined, the magnetic field at any point may be calculated from the relation

$$\frac{\frac{B}{|B_{\infty}|}}{|B_{\infty}|} = \frac{\rho}{\rho_{\infty}} \frac{\Delta \ell}{|\Delta \ell_{\infty}|}$$
 (55)

where $\Delta \ell$ is the vector length of a small element of a flux tube. Figure 6 clarifies these quantities for the plane of magnetic symmetry defined by the plane containing the axis of symmetry of the obstacle and the magnetic-field lines upstream of the bow wave for the special case when the latter is perpendicular to the flow. In that figure the open symbol O denotes locations of points on the streamlines corresponding to the fixed-time interval $\Delta t = \Delta S_m/v_m$.

Such a procedure is valid generally, but its use in the present calculations is confined to only the component of the magnetic field (B), just described. The remainder of the magnetic-field calculation makes use of a decomposition due to Alksne and Webster (ref. 20) in which the axisymmetric properties of the gasdynamic solution and the linearity of the magnetic-field eqs. (54) are employed to derive the following relationship for the magnetic field B_p at any point P:

$$\underline{B}_{p} = \left(\frac{\underline{B}_{p}}{\underline{B}_{\infty}}\right)_{\parallel} B_{\infty_{\parallel}} + \left(\frac{\underline{B}_{p}}{\underline{B}_{\infty}}\right)_{\perp} B_{\infty_{\perp}} + \hat{e}_{n} \left(\frac{\underline{B}_{p}}{\underline{B}_{\infty}}\right)_{n} B_{\infty_{n}}$$
(56)

As illustrated in figure 7, subscripts ", $^{\perp}$, and n refer to contributions associated with the components B_{∞} of B_{∞} parallel to v_{∞} ; the component B_{∞} perpendicular to v_{∞} in the plane that contains the point P, the center of the planet, and the vector v_{∞} ; and the component B_{∞} normal to the latter plane, and \hat{e}_n is a unit vector in the latter direction. The unit ratios $(B_p/B_{\infty})_n$ and $(B_p/B_{\infty})_n$ can be calculated directly from the gasdynamic solution by the expressions

$$\left(\frac{\mathbb{B}_{\mathbf{p}}}{\mathbb{B}_{\infty}}\right)_{\mathbf{n}} = \frac{\rho_{\mathbf{p}} \mathbf{y}_{\mathbf{p}}}{\rho_{\infty} |\mathbf{y}_{\infty}|}, \quad \left(\frac{\mathbb{B}_{\mathbf{p}}}{\mathbb{B}_{\infty}}\right)_{\mathbf{n}} = \frac{\mathbb{R}_{\mathbf{p}} \rho_{\mathbf{p}}}{\mathbb{R}_{\mathbf{p}_{\infty}} \rho_{\infty}} \tag{57}$$

where $R_{\mathbf{p}}$ is the radial cylindrical coordinate of the streamline through P, as indicated in figure 7.

In carrying out the determination of $(B_p/B_{\infty})_{\perp}$ using eq. (55), values for $\Delta \ell/|\Delta \ell_{\infty}|$ are determined initially at the points where the streamlines and perpendicular-component field lines intersect. A generalized quadrilateral interpolation scheme followed by a fifth-order smoothing is then employed to determine the corresponding values at the computational grid points where values for ρ/ρ_{∞} are available for calculation of $(B_p/B_{\infty})_{\perp}$. At the bow shock, an exact formula is used

$$(|\Delta \ell|/|\Delta \ell_{\infty}|)^{2} = 1 + \cot^{2}\theta(1+D^{2}) - 2D \times \csc\theta \times \cot\theta \times \cos(\theta-\delta)$$

$$\psi = \theta + \sin^{-1}\left\{[D \times \cot\theta \times \sin(\theta-\delta)]/(|\Delta \ell|/|\Delta \ell_{\infty}|)\right\}$$
(58)

where

$$D^{2} = 1 - 4 (M_{\infty}^{2} \sin^{2} \theta - 1) (\gamma M_{\infty}^{2} \sin^{2} \theta + 1) / [(\gamma + 1)^{2} M_{\infty}^{4} \sin^{2} \theta]$$

$$\cot \delta = \tan \theta \times \left\{ (\gamma + 1) M_{\infty}^{2} / [2 (M_{\infty}^{2} \sin^{2} \theta - 1)] - 1 \right\}$$

$$\theta = \tan^{-1} \left[\frac{dR_{S}}{dX} \right]$$
(59)

Finally, the resultant magnetic field can then be expressed in components relative to any orthogonal (X,Y,Z) coordinate system. For convenience of illustration, we have chosen the point P to lie in the (X,Y) plane. Relative to this reference frame, the magnetic components are

$$B_{X}/B_{\infty} = \left[(|\underline{B}|/B_{\infty})_{n} \cos \phi \cos \alpha_{p} + (|\underline{B}|/B_{\infty})_{1} \cos \psi \sin \alpha_{p}) \right] \cos \alpha_{n}$$

$$B_{Y}/B_{\infty} = \left[(|\underline{B}|/B_{\infty})_{n} \sin \phi \cos \alpha_{p} + (|\underline{B}|/B_{\infty})_{1} \sin \psi \sin \alpha_{p}) \right] \cos \alpha_{n}$$

$$B_{Z}/B_{\infty} = (B/B_{\infty})_{n} \sin \alpha_{n}$$
(60)

where ϕ is the local flow angle given by

$$\phi = \tan^{-1} \left(\frac{\mathbf{v}}{\mathbf{u}} \right) \tag{61}$$

and the interplanetary magnetic field angles α_p and α_n indicated in figure 7 are defined by

$$\alpha_{\rm p} = \tan^{-1} \left[\frac{B_{\infty}}{B_{\infty}} \right] = \tan^{-1} \left[\frac{B_{\rm Y}}{B_{\rm X}} \right]$$
 (62)

$$\alpha_{n} = \tan^{-1} \left[\frac{B_{\infty}}{\sqrt{(B_{\infty_{\parallel}})^{2} + (B_{\infty_{\perp}})^{2}}} \right] = \tan^{-1} \left[\frac{B_{Z_{\infty}}}{\sqrt{(B_{X_{\infty}})^{2} + (B_{Y_{\infty}})^{2}}} \right]$$
 (63)

The generalizations of these results when the point P is at some arbitrary (Y,Z) location, i.e. not in the (X,Y) plane, are provided below in the spacecraft trajectory section.

Calculation of the Contour Lines

Contours are calculated for nondimensionalized velocity $|y|/v_{\infty}$, density ρ/ρ_{∞} , magnetic field components $(|B|/B_{\infty})_{n}$, $(|B|/B_{\infty})_{n}$, and $(B/B_{\infty})_{n}$ by application of a modified version of a contour procedure developed at NASA/Ames Research Center. After specifying a value for the contour line, the boundary is searched for intervals which bracket the selected value. After locating one such point by interpolation, the remainder of the contour is determined by 'walking' around the contour, searching at each step for the interval and then interpolating to find the point through which the contour line next passes. This is repeated until a boundary

point is reached. Then closed contours are found in a similar manner. Linear interpolation is used throughout the process. Since the temperature is a function of $|y|/v_m$ only for a specified M_m and γ ,

$$T/T_{\infty} = 1 + \left[\left(\frac{\gamma - 1}{2} \right) M_{\infty}^{2} \right] \left[1 - \left(\frac{|v|}{v_{\infty}} \right)^{2} \right]$$
 (64)

velocity contours may also be considered as temperature contours with only a relabeling required. The coordinates of the contour lines are output either or both as listings and pen plots.

Solar-Ecliptic/Solar-Wind Coordinate Transformations

In order to facilitate comparison of results from the current theoretical model with actual observational data obtained by a spacecraft, it is necessary to consider the appropriate transformations between the spacecraft and solar-wind coordinate systems. Part of the data required as input to the theoretical model consists of oncoming interplanetary values of solar-wind temperature, density, and velocity and magnetic-field vector components. These are naturally obtained in the spacecraft coordinate system, and are usually reported in a sun-planet or solarecliptic reference frame. The key coordinate system for the theoretical model is one which aligns the axial direction with the oncoming solar wind, since the gasdynamic calculation is assumed to be axisymmetric about this direction. Thus, the interplanetary input data must be transformed to the solar-wind system to initiate the theoretical determination. Once the gasdynamic and magnetic-field calculations in the solarwind system are complete, those results must then be transformed back to the sun-planet system to allow direct comparison with spacecraft data obtained at arbitrary locations in the solar-wind/ionosphere interaction region. Consequently, direct and inverse transformations for both spatial coordinates as well as vector quantities between these reference frames are required.

For the measurements of the oncoming interplanetary solar-wind velocity we have assumed that the velocity is obtained with reference to a

sun-planet (x_g,y_g,z_g) system with origin at planetary center and in which the x_g -axis points to the sun, the y_g -axis is opposite to the planetary orbital motion, and the z_g -axis points northward. The direction of the oncoming solar wind is such that the total abberation or azimuthal angle, including planetary orbital motion, of the solar-wind velocity vector in the plane of the ecliptic is Ω and the out-of-ecliptic plane or polar angle is ϕ_p . The positive sense of the azimuthal angle is for east-to-west flow and for the polar angle for north-to-south flow, as indicated in figure 8. In that figure we have also indicated the solar-wind (x,y,z) coordinate system so defined by (Ω,ϕ_p) . For the gas-dynamic calculation, the (x,y,z) system is somewhat inconvenient since the direction of solar-wind flow is in the negative x-direction. Hence, the internal gasdynamic and magnetic-field calculations are performed in an (X,Y,Z) system as shown in figure 9.

The coordinate and vector transformations from the ecliptic sun-planet (x_s, y_s, z_s) system to the (X, Y, Z) solar-wind system are given by

$$\begin{pmatrix}
Q_{X} \\
Q_{Y} \\
Q_{Z}
\end{pmatrix} = \begin{pmatrix}
-\cos \Omega \cos \phi_{p} & -\sin \Omega \cos \phi_{p} & \sin \phi_{p} \\
\sin \Omega & -\cos \Omega & 0 \\
-\cos \Omega \sin \phi_{p} & \sin \Omega \sin \phi_{p} & \cos \phi_{p}
\end{pmatrix} \begin{pmatrix}
Q_{x} \\
Q_{y} \\
Q_{y} \\
Q_{z} \\
Q_{z} \\
\end{pmatrix} (65)$$

where (Q_X, Q_Y, Q_Z) represents the Cartesian components of any vector referred to the solar-wind (X,Y,Z) coordinate system, and $(Q_{X_S},Q_{Y_S},Q_{Z_S})$ represents the corresponding vector in the sun-planet ecliptic (x_S,y_S,z_S) system. Thus, for a transformation of coordinates

$$(Q_{x}, Q_{y}, Q_{z}) = (X, Y, Z)$$

$$(Q_{x_{s}}, Q_{y_{s}}, Q_{z_{s}}) = (x_{s}, Y_{s}, Z_{s})$$
(66)

while for a vector transformation of, say, the magnetic field

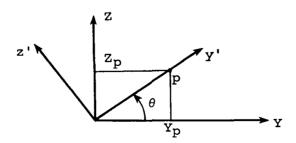
$$(Q_{x}, Q_{y}, Q_{z}) = (B_{x}, B_{y}, B_{z})$$
 $(Q_{x_{s}}, Q_{y_{s}}, Q_{z_{s}}) = (B_{x_{s}}, B_{y_{s}}, B_{z_{s}})$
(67)

The inverse transformation from the solar-wind to the sun-ecliptic system is given by

$$\begin{bmatrix}
Q_{X_{S}} \\
Q_{Y_{S}} \\
Q_{Z_{S}}
\end{bmatrix} = \begin{bmatrix}
-\cos \Omega \cos \phi_{p} & \sin \Omega & -\cos \Omega \sin \phi_{p} \\
\sin \Omega \cos \phi_{p} & -\cos \Omega & \sin \Omega \sin \phi_{p} \\
\sin \phi_{p} & 0 & \cos \phi_{p}
\end{bmatrix} \begin{bmatrix}
Q_{X} \\
Q_{Y} \\
Q_{Z}
\end{bmatrix}$$
(68)

Properties Along a Spacecraft Trajectory

One of the primary aims of the present effort has been the development of the capability to determine plasma and magnetic-field properties, as predicted by the present theoretical model, at locations specified along an arbitrary spacecraft trajectory, and in such a form as to enable comparisons to be made directly with actual spacecraft data. To this end, the following procedure has been developed and implemented in the associated computer code. First, from the known oncoming interplanetary conditions provided in a sun-planet reference frame, the azimuthal and polar solar-wind angles (Ω,ϕ_D) are employed to establish both the location of the trajectory point in the solar-wind (X,Y,Z) frame as well as the interplanetary magnetic-field components (B_{X_m} , B_{Y_m} , B_{Z_m}) using the transformation eq. (65). Next, the axisymmetric gasdynamic and unit magnetic-field calculations are carried out. Because the gasdynamic flow is axisymmetric in the (X,Y,Z) system, the internal coordinate system in which the trajectory calculations are actually performed may be rotated about the X axis into the most convenient orientation. If we consider a point P located at (X_p, Y_p, Z_p) , then the rotation most appropriate for the present application is indicated in the sketch below



where the angle θ is given by

$$\theta = \tan^{-1} \left[\frac{z_p}{Y_p} \right] \tag{69}$$

This rotation defines a new coordinate system (x',y',z') where

$$\begin{pmatrix} \mathbf{x}' \\ \mathbf{y}' \\ \mathbf{z}' \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & \sin \theta \\ 0 & -\sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} \mathbf{x} \\ \mathbf{y} \\ \mathbf{z} \end{pmatrix}$$
(70)

in which

$$x' = X_{p}$$

$$y' = \sqrt{Y_{p}^{2} + Z_{p}^{2}}$$

$$z' = 0$$
(71)

Thus, the (x',y') plane which contains the X axis and the arbitrary point P corresponds directly to the plane (X,R) = $(X_p, \sqrt{Y_p^2 + Z_p^2})$ in which the axisymmetric gasdynamic flow properties are calculated. In particular, the velocity magnitude v, density ρ , and flow angle ϕ at the point P are found by bilinear interpolation through the (X,R) flow-field grid. The vector velocity in the (X,Y,Z) system is then given by the transformation

$$\begin{pmatrix} v_{X} \\ v_{Y} \\ v_{Z} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & -\sin \theta \\ 0 & \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} v \cos \phi \\ v \sin \phi \\ 0 \end{pmatrix}$$
(72)

and then in the sun-ecliptic system by the transformation given in eq. (68)

$$\begin{bmatrix} v_{x_{s}} \\ v_{y_{s}} \\ v_{z_{s}} \end{bmatrix} = \begin{bmatrix} -\cos \alpha \cos \phi_{p} & \sin \alpha & -\cos \alpha \sin \phi_{p} \\ \sin \alpha \cos \phi_{p} & -\cos \alpha & \sin \alpha \sin \phi_{p} \\ \sin \phi_{p} & 0 & \cos \phi_{p} \end{bmatrix} \begin{bmatrix} v_{x} \\ v_{y} \\ v_{z} \end{bmatrix}$$
(73)

Calculation of the magnetic field at an arbitrary point is somewhat more complicated since these components are dependent upon the orientation of the incident interplanetary magnetic field. With the known $(B_{X_{\infty}}, B_{Y_{\infty}}, B_{Y_{\infty}}, B_{Z_{\infty}})$ components, the corresponding components $(B_{X_{\infty}}, B_{Y_{\infty}}, B_{Z_{\infty}})$ in the rotated (x', y', z') system are given by

$$\begin{pmatrix}
B_{X_{\infty}}^{\dagger} \\
B_{Y_{\infty}}^{\dagger} \\
B_{Z_{\infty}}^{\dagger}
\end{pmatrix} = \begin{pmatrix}
1 & 0 & 0 \\
0 & \cos \theta & \sin \theta \\
0 & -\sin \theta & \cos \theta
\end{pmatrix}
\begin{pmatrix}
B_{X_{\infty}} \\
B_{Y_{\infty}} \\
B_{Z_{\infty}}
\end{pmatrix}$$
(74)

In this reference frame, the perpendicular, parallel, and normal interplanetary components are identified as

$$B_{\infty_{\parallel}} = B_{X_{\infty}}^{!}$$

$$B_{\infty_{\perp}} = B_{Y_{\infty}}^{!}$$

$$B_{\infty_{n}} = B_{Z_{\infty}}^{!}$$
(75)

Then, the magnetic field angles $\alpha_p^{\text{!`}}$ and $\alpha_n^{\text{!`}}$ in the rotated system are given by

$$\alpha_{\mathbf{p}}^{\prime} = \tan^{-1} \left[\frac{\mathbf{B}_{\infty}}{\mathbf{B}_{\infty}} \right] = \tan^{-1} \left[\frac{\mathbf{B}_{\infty}^{\prime}}{\mathbf{B}_{\infty}^{\prime}} \right]$$
 (76)

$$\alpha_{n}^{\prime} = \tan^{-1} \left[\frac{B_{\infty}}{\sqrt{\left(B_{\infty,i}^{\prime}\right)^{2} + \left(B_{\infty,i}^{\prime}\right)^{2}}} \right] = \tan^{-1} \left[\frac{B_{Z_{\infty}^{\prime}}^{\prime}}{\sqrt{\left(B_{X_{\infty}^{\prime}}^{\prime}\right)^{2} + \left(B_{Y_{\infty}^{\prime}}^{\prime}\right)^{2}}} \right]$$
(77)

The magnetic angle ψ associated with the incident perpendicular component and the unit magnetic-field ratios $(|B|/B_{\omega})_{\mathbf{n}}$, $(|B|/B_{\omega})_{\mathbf{n}}$, $(B/B_{\omega})_{\mathbf{n}}$ in the rotated system are next determined by bilinear interpolation through the flow-field grid. Then, the magnetic-field components $(B_{\mathbf{x}}^{\mathbf{t}},B_{\mathbf{y}}^{\mathbf{t}},B_{\mathbf{z}}^{\mathbf{t}})$ in the rotated system are calculated from

$$B_{X}' = \cos \alpha_{n}' \left[\cos \phi \cdot \cos \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{n} + \cos \psi \cdot \sin \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{1} \right] \cdot B_{\infty}$$
 (78)

$$B_{y}^{\prime} = \cos \alpha_{n}^{\prime} \left[\sin \phi \cdot \cos \alpha_{p}^{\prime} \cdot \left| \frac{\tilde{B}}{B_{\infty}} \right|_{n} + \sin \psi \cdot \sin \alpha_{p}^{\prime} \cdot \left| \frac{\tilde{B}}{B_{\infty}} \right|_{1} \right] \cdot B_{\infty}$$
(79)

$$B_{z}^{\prime} = \sin \alpha_{n}^{\prime} \cdot \left(\frac{B}{B_{\infty}}\right)_{n} \cdot B_{\infty}$$
 (80)

The magnetic-field components in the solar-wind (X,Y,Z) system are then determined from the rotational transformation.

$$\begin{pmatrix} B_{X} \\ B_{Y} \\ B_{Z} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \theta & -\sin \theta \\ 0 & \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} B_{X}^{\dagger} \\ B_{Y}^{\dagger} \\ B_{Z}^{\dagger} \end{pmatrix}$$
(81)

and finally in the sun-planet system from

$$\begin{bmatrix}
B_{x_{s}} \\
B_{y_{s}} \\
B_{z_{s}}
\end{bmatrix} = \begin{bmatrix}
-\cos \alpha \cos \phi_{p} & \sin \alpha & -\cos \alpha \sin \phi_{p} \\
\sin \alpha \cos \phi_{p} & -\cos \alpha & \sin \alpha \sin \phi_{p} \\
\sin \phi_{p} & 0 & \cos \phi_{p}
\end{bmatrix} \begin{bmatrix}
B_{x} \\
B_{y} \\
B_{z}
\end{bmatrix}$$
(82)

RESULTS

Using the computational procedures developed under the current modeling effort, a large variety and number of different solar-wind/planetary-ionosphere interraction results were systematically obtained. These results were directed toward the following specific objectives: (1) verification of the correctness of the procedures, (2) demonstration of their flexibility and generality for a variety of cases covering ranges typical of solar-wind conditions, (3) establishment of a catalog of flow and magnetic-field results for a large number of solar-

wind flows, and (4) comparisons of theoretical predictions with data obtained from spacecraft measurements. The results obtained associated with these objectives are discussed below.

Verification of the correctness of the procedures developed under the current effort primarily involved testing the computational extensions developed regarding both the gasdynamic and magnetic-field calculation methods reported in ref. 9. For the gasdynamic solver, this consists of demonstrating the extended blunt-body capability. As discussed previously in the section describing the nose-region solution and also in section A.2.1.1 of the computer manual, that extension involves the addition to the nose-region flow field of a region downstream of the dawn-dusk terminator - which is the usual plane terminating the noseregion solution. This added capability effectively removes any restriction with regard to obstacle shape and interplanetary gasdynamic Mach number of the previous procedures (ref. 9); and permits the calculation of ionopause shapes which have significant flaring in the radial direction at the dawn-dusk terminator, as well as flows at very low $(M_m \approx 2.0)$ free-stream Mach numbers. In figure 10, we present results for the bow shock locations for $M_{\infty} = 8.0$, $\gamma = 5/3$ flow past constant scale-height ionopause shapes (see eq. (36a) with $H/R_0 = 0.5$ and 1.0. The downstream solutions for neither of these shapes could be determined with the previous procedures (ref. 9), whereas with the present method they present no problem. The downstream locations to which the nose-region solutions were extended were $X/R_0 = (0.54, 0.67)$, respectively, for the $H/R_0 = (0.5, 1.0)$ ionopause shapes - indicating that the addition of an extensive downstream region to the nose solution for such flows is unnecessary. This is important, as the nose-region solver requires significantly more computational time for a given flow-field region than the marching solver. Hence, minimization of the nose-region flow field is essential in minimizing the total computational time.

In figure 11, we display additional results using the extended nose-region grid capability to demonstrate the ability of the current method for calculating very low interplanetary gasdynamic Mach number flows. Bow shock locations are shown for $\rm M_{\infty}=2.0$ and 3.0, $\gamma=5/3$ flows past an

ionopause obstacle shape with gravitational variation included in scale-height having $\overline{H}/R_O=0.25$ (see eq. (36b)). This particular obstacle is a relatively blunt shape, as can be observed from the ionopause profiles presented previously in figure 1, and, computationally, presents a more difficult flow to determine than flows for shapes having less flaring. For applications to terrestrial planets, such as Mars and Venus, typical ionopause shapes occurring in nature appear to lie in the range $0.01 \lesssim \overline{H}/R_O \lesssim 0.10$. Consequently, demonstration of the ability of the current procedures to treat successfully such flows as shown in figures 10 and 11 – which lie at the limits of interest as far as applications to nonmagnetic terrestrial planets, indicates that these procedures will not be restricted insofar as ionopause geometry and interplanetary solar-wind conditions are concerned.

Corresponding verification of the extensions to the procedures for the magnetic-field calculation has involved demonstration of the correctness of the magnetic-field prediction at any arbitrary point in the solar-wind flow field. This was accomplished by consideration of a variety of special test cases in which the location in the flow field and the incident interplanetary magnetic-field orientation were systematically changed so as to produce both symmetric and antisymmetric changes in the resultant ionosheath magnetic field, as well as to reverse the roles of the perpendicular and normal components. All of these various permutations of the magnetic-field calculation procedure were successfully verified.

One of the primary objectives of the present work was to demonstrate the flexibility and generality of the present procedures by exercising them over a wide range of ionopause geometries and solar wind oncoming conditions so as to cover, insofar as possible, the entire range of practical interest of these parameters. These calculations were to be summarized in a convenient format and then archived so as to provide at-a-glance information regarding the variation of the flow-field and unit magnetic-field quantities. The output format selected was the automatic pen-plot output option of the program involving plots of the flow-field streamlines, and contours of the velocity magnitude $|\mathbf{y}|/\mathbf{v}_{\infty}$, temperature $\mathbf{T}/\mathbf{T}_{\infty}$, density ρ/ρ_{∞} , and the field-line locations and contours of the unit magnetic-field ratios $(|\mathbf{B}|/\mathbf{B}_{\infty})$ and $(|\mathbf{B}|/\mathbf{B}_{\infty})_1$.

The test cases selected for this catalog involved a ratio of specific heats γ = 5/3 and the following matrix of free-stream Mach numbers M $_{\infty}$ and ionopause shapes:

$$M_{\infty} = \{2.0, 3.0, 5.0, 8.0, 12.0, 25.0\}$$
 $H/R_{O} = \{0.01, 0.10, 0.25\}$
 $\overline{H}/R_{O} = \{0.10, 0.20, 0.25\}$

Thus, a total of 36 separate cases were calculated. The plot output for these cases is provided in Appendix B, which also presents a convenient page index to the individual results. These archived results provide an very convenient means of determining the overall dependence of flow-field and magnetic-field quantities with $\rm M_{\infty}$ and obstacle shape, in particular the variation of bow shock location and flow-field contour changes. We note that the range of free-stream Mach numbers selected easily spans the entire range of solar-wind conditions usually encountered, while the different obstacle shapes provide a wide variation as well, as can be observed from figure 1.

The final and ultimate check of the current procedures lies in the comparison of the results predicted by the present model with data actually measured by a spacecraft. To that end, we have made a number of preliminary comparisons with data obtained from orbits 3 and 6 of the Pioneer-Venus Orbiter spacecraft.

The overall features of the spacecraft trajectory crossings of the solar-wind/Venus-ionosphere interaction region are provided in the sketch given in figure 12. In that figure, which is referred to the sun-Venus solar-ecliptic coordinate system, we note in particular the highly elliptic spacecraft orbit (periapsis $\simeq 200$ Km, apoapsis $\simeq 66,000$ Km) and the crossings of the bow shock and ionopause surfaces. The oncoming solar-wind direction, with arbitrary azimuthal (aberration) and polar angles (Ω,ϕ_p) is as indicated, with the ionopause and bow shock surfaces symmetric about that direction. The oncoming arbitrary interplanetary magnetic field B is also as indicated.

The procedural outline employed for the theoretical comparisons is as follows:

I. Orbital data selection

Select data from an orbit when solar-wind conditions are relatively steady.

II. Theoretical calculations

Input:

Ionospheric ρ and T versus altitude from orbiter retarding potential analyzer (ORPA)

Solar wind y_m , ρ_m , T_m from orbiter plasma analyzer (OPA)

Solar wind B_m from orbiter magnetometer (OMAG)

Trajectory coordinates

Output: (Contours and/or time histories along orbital trajectory)

Ionosheath ρ , T, v, v and their scalar components in solar ecliptic coordinates

III. Comparisons with Spacecraft data

Observational ionosheath data for ρ , $|\underline{v}|$, T from OPA and for B from OMAG with two sets of theoretical predictions based on {last } interplanetary solar-wind properties $(v_{\infty},\ T_{\infty},\ \rho_{\infty},\ B_{\infty})$ measured {before } bow shock {inbound } crossings.

First, the selection of the particular orbit for which theoretical calculations and data comparisons will be carried out must be made. This choice is based on spacecraft observations of the oncoming interplanetary solar wind, and for the cases reported here, the selections were made when conditions appeared relatively steady. In particular, the interplanetary conditions regarding solar-wind velocity, density, temperature and magnetic field based on the orbiter solar-wind plasma analyzer (OPA) and fluxgate magnetometer (OMAG) measurements just prior

to inbound bow shock crossing and immediately after outbound bow shock crossing were analyzed by the Pioneer-Venus investigators responsible for these instruments for a number of the initial orbits of the Pioneer-Venus spacecraft, and on this basis the selection of Orbits 3 and 6 were made.*

To initiate the theoretical calculations, information regarding both the ionospheric obstacle shape and the oncoming interplanetary conditions are required. The determination of the obstacle shape is based on measurements of atmospheric density and temperature as a function of altitude made by the orbiter retarding potential analyzer at (ORPA) locations interior to the ionopause boundary.** These measurements yield the variation of atmospheric pressure with altitude in the vicinity of ionopause altitudes. From this information, the value of the scale-height parameter from the atmospheric pressure model given by either eq. (29) or (30) can be determined. For Venus, it appears that the ionosphere/solar-wind interaction is such that the ionopause wraps tightly about the planet (ref. 10). Our calculations based on ORPA data for Orbits 3 and 6 indicate scale heights of approximately 200 Km, which yield a corresponding range of values for H and \overline{H} of 0.02 \leq H/R, \overline{H}/R \leq 0.05. We note that for such small values of scale height, the two ionospheric pressure models eqs. (29) and (30) yield essentially the same obstacle shape, as can be seen from figure 1. For the comparisons reported here for both Orbits 3 and 6, we have selected a value of $\overline{H}/R_0 = 0.03$. With regard to oncoming interplanetary conditions, we require as input the solar-wind bulk velocity y_{∞} , density $\rho_{\dot{\omega}}$, temperature $T_{\dot{\omega}}$, and magnetic field $B_{\dot{\omega}}$. The first three are provided by the orbiter plasma analyzer (OPA), while the magnetic field is given by the orbiter fluxgate magnetometer (OMAG). We note that the OPA provides either ion density and temperature or electron density and temperature, but not both simultaneously. For orbits 3 and

Special thanks are due to J. H. Wolfe and J. P. Mihalov who provided information regarding the solar-wind plasma from OPA measurements (refs. 21,22) and to C. T. Russell, R. C. Elphic, and J. A. Slavin for magnetic-field information from OMAG measurements (refs. 23,24).

^{**} Special thanks are due to W. C. Knudsen and K. Spenner for providing the ionospheric plasma information from ORPA measurements (refs. 10,11).

6, ion measurements were available and have been employed. Information regarding the oncoming direction of the solar wind, as given by the angles (Ω,ϕ_p) , defines the requisite coordinate rotations required to align the gasdynamic calculation in the oncoming solar-wind direction; while information of solar-wind speed, density, and temperature serve to define the oncoming gasdynamic Mach number required to initiate the gasdynamic calculations.

With this information, the detailed qasdynamic and unit magnetic-field calculations in the ionosheath region can be carried out. In order to provide an idea of the detail obtained by the present computational procedures in these calculations, we have displayed in figure 13 the flow-field grid for one of the gasdynamic flow solutions used in the data comparisons discussed below. The result shown is for $M_{\infty} = 3.0$, $\gamma = 5/3$ flow past an ionopause obstacle shape with \overline{H}/R_{\odot} = 0.03, and is shown carried to a downstream location of $X/R_0 = 3.0$. The flow field properties $[v/v_{\infty}, \rho/\rho_{\infty}, T/T_{m}]$ and the unit frozen magnetic-field ratios $[(B/B_{\infty})_{\mu}, (B/B_{\infty})_{\mu}]$ are determined at each intersection of the grid lines, including the bow shock, stagnation streamline, and ionopause boundaries. The final output of the calculaton consists of detailed flow-field and magnetic-field properties in the ionosheath region, both in terms of tabular output and plotted contours and time histories along the orbital trajectory of the velocity magnitude and components, density, temperature, and magnetic-field magnitude and components. Complete details are provided in section A.4 of the Computer User's Manual.

In figure 14, we have displayed some overall flow-field results for Orbit 6. Indicated in that figure are bow shock locations for the three combinations of free-stream Mach number M_{m} and plasma specific heat ratio γ , i.e. $(M_{m}, \gamma) = (13.3, 5/3)$, (13.3, 2), (3.0, 5/3) for flow about an ionopause with $\overline{H}/R_0 = 0.03$. Also indicated are two sets of points (- \odot -, -⊡-) representing the spacecraft trajectory for orbit 6 as viewed in two solar-wind oriented coordinate systems. The trajectory indicated by the solid lines and circles $(-\bigcirc -)$ is that based on the last measured direction $(\Omega, \phi_p) = (6.5^{\circ}, -1.4^{\circ})$ of the interplanetary solar wind just prior to crossing the bow shock on the inbound leg, while the dashed line and squares (---) denotes the trajectory based on the first measured direction $(\Omega, \phi_p) = (4.9^{\circ}, 7.6^{\circ})$ of the solar wind immediately after crossing the bow shock on the outboard leg. We note that the spatial location of the spacecraft trajectory in solar-wind coordinates depends only on the direction (Ω,ϕ_n) of the oncoming solar wind, but not on its magnitude. With regard to the results indicated in figure 14 for the spacecraft trajectory, we observe the extremely large dependence of spatial position of a trajectory point, as viewed in solar-wind coordinates, on solar-wind direction. For the particular inbound and outbound solar-wind angles indicated, the shift in X-coordinate of a trajectory point can be as high as a quarter of the Venusian planetary radius, which obviously results in substantial differences in predicted flow and magnetic-field properties. In previous work, the influence of the angular shift in the solar wind was generally considered to be small and negligible. The current results, however, indicate that this purely geometrical effect can be surprisingly large, even for directional shifts of less than 5°, and must be accounted for in any realistic theoretical comparison with data. See reference 7 for another example of the importance of this effect.

Finally, with regard to the three sets of bow shock results displayed in figure 14, these calculations represent an attempt to resolve the uncertainty in the oncoming free-stream Mach number and ratio of specific heats of the plasma. Because only solar-wind ion temperatures from the OPA were available for Orbit 6, the initial calculation of the free-stream Mach number was based on the assumption that $T_e = T_i$, which leads to $M_\infty = 13.3$. A ratio of specific heats $\gamma = 5/3$ was assumed, and these interplanetary values result in the bow shock indicated by the

dot-dash line. That shock location is in poor agreement with the observational shock crossings, indicated as occurring between the pairs of solid circles and squares. A separate uncertainty arises from the possibility that the magnetic field may act to align the plasma particle motion in its direction, thus effectively reducing the number of degrees of translational freedom from 3 to 2 and thereby increasing the ratio of specific heats from 5/3 to 2. To investigate this possibility, we have repeated the M_{∞} = 13.3 calculation using γ = 2. That result is indicated by the dashed line, and is in better but still not completely satisfactory agreement with the observed shock locations. Finally, if it is assumed that the oncoming interplanetary electron temperature is not equal to the ion temperature, but is substantially higher, we are lead to low Mach numbers of the order of $M_m \simeq 3-5$. We have displayed bow shock results of a $M_m = 3.0$, $\gamma = 5/3$ calculation in figure 14 as the solid line, and observe that based on this Mach number and the inbound solar-wind direction, the observational shock crossings display very good agreement with the theoretical results.

Figure 15 displays the time-history comparisons of the theoretically-predicted bulk plasma density, speed and temperature in the ionosheath region with OPA measurements of these quantities. These theoretical results were based on a gasdynamic flow solution with M = 13.3, γ = 2.0. In these results, the solid lines with circles correspond to results based on inbound interplanetary conditions, while the dashed lines with squares correspond to outbound conditions. We note that while the few data points available are in general agreement with the theoretical calculations, the lack of more detailed plasma measurements in the ionosheath prevents a definitive conclusion. The OPA instrument requires approximately 9 minutes to acquire sufficient data to enable predictions of the bulk plasma quantities. While this time lag presents no problem when the spacecraft is in the interplanetary solar wind, the large resolution time effectively averages the plasma quantities in the ionosheath over such a large spatial range that only overall comparisons of the bulk plasma properties are possible.

The situation is quite different for the magnetic field, as the OMAG instrument provides essentially instantaneous magnetic-field measurements. Comparisons of the frozen magnetic-field predictions with data

are displayed in figures 16(a,b). These comparisons employ the gasdynamic solution $M_m = 13.3$, $\gamma = 2$ for which plasma properties were given in figure 15. In figure 16a, we display two sets of theoretical calculations for the magnitude of the magnetic field, based on the inbound and outbound interplanetary magnetic field conditions as indicated on the figure. In these comparisons, we observe very good agreement with both sets of predictions. In particular, on the inbound leg, the theoretical predictions based on the inbound interplanetary conditions are in very good agreement with the data, while the outboundcondition predictions are clearly not as favorable. On the other hand, as we proceed in time along the outbound leg, the opposite is true. Here, the outbound-condition predictions are in very good agreement with the data, while the inbound-condition predictions are notably inferior, particularly with regard to shock crossing. Corresponding results for the magnetic-field components are provided in figure 16b, and display a similar behavior. The agreement of the theoretical results with data for the individual components is remarkable, confirming the accuracy of the frozen-field model, as well as the shift of the ionosheath magnetic field from a solution related to inbound interplanetary conditions to one related to outbound conditions.

For Orbit 3, similar comparisons as those shown in figures 14-16 for Orbit 6 are given in figures 17 to 19. In figure 17, we have provided the bow shock locations for five different combinations of M_{∞} and γ as indicated. The Mach numbers $M_{\infty}=7.38$, 5,96 correspond, respectively, to the inbound and outbound interplanetary conditions for $|\mathbf{v}_{\infty}|$, ρ_{∞} , T_{∞} as measured by the OPA, while the two values of $\gamma=5/3$,2 used in the calculations represent our uncertainty of the ratio of plasma specific heats. We have also indicated for reference the bow shock location for $M_{\infty}=3.0$, $\gamma=5/3$ as given previously in figure 14 for Orbit 6. Note that the observational shock crossings are again closest to the $M_{\infty}=3.0$, $\gamma=5/3$ shock. Also provided in figure 17 are the orbital trajectories as viewed in solar-wind coordinates for the inbound $(\Omega, \phi_{\rm p})=(3.3^{\circ}, 0.15^{\circ})$ and outbound $(\Omega, \phi_{\rm p})=(3.7^{\circ}, 4.9^{\circ})$ solar-wind directions.

The comparisons for the bulk plasma properties for Orbit 3 are provided in figure 18. Again we note an overall agreement for bulk plasma speed and density, but note an observable discrepancy in the temperature.

This is thought to be indicative of the manner in which the bulk properties from the theoretical model are being interpreted in relation to the observational measurements; i.e. the theoretical values correspond to those for a single-component plasma, while the measurements are in terms of a multi-component plasma. Whether the theoretical plasma properties require rescaling or reformulation, or whether their present formulation is appropriate for comparison with the multi-component data, appears to be a necessary and important subject for future study.

Results for the magnetic-field comparisons are displayed in figures 19(a,b), which provide time-histories of both the magnitude and the individual magnetic-field components based on both inbound and outbound interplanetary conditions. We note again, although the shock crossing comparisons are somewhat in disagreement since the gasdynamic flow fields used in these results were for $\rm M_{\infty}=7.56,\ 5.96$ and $\rm \gamma=2$, the reasonable comparisons are obtained for the ionosheath magnetic field. In particular, we observe the drift with time along the trajectory of the trajectory of the agreement of theory with data from the predictions based on inbound interplanetary conditions on the inbound leg, to those based on outbound conditions on the outbound leg.

In order to demonstrate the improvement obtained in magnetic-field results when a gasdynamic flow-field solution is employed which more closely agrees with the observational bow shock location, we have displayed in figure 20(a,b) the analogous time-history magnetic-field comparisons when using a $M_{\infty}=3.0,\,\gamma=5/3$ gasdynamic result. In this case, results were computed for only the inbound direction $(\Omega,\varphi_p)=(3.3^{\circ},\,0.15^{\circ})$ of the solar wind. As can be seen, there is a marked improvement in the agreement near the bow shock, and quite good agreement throughout the ionosheath as well as, for both the magnitude and the individual magnetic-field components. We note that the general agreement of theory and observation of the individual components demonstrates both the accuracy of the calculation and, in particular, the need for accounting in the theoretical results of the variable direction of the interplanetary solar wind.

CONCLUDING REMARKS

The application of advanced computational procedures was undertaken for the purpose of modeling the interaction of the solar wind with nonmagnetic planets, with particular emphasis on Venus. Based on the successful theoretical model employed previously (ref. 9), i.e., the steady, dissipationless, magnetohydrodynamic model for axisymmetric, supersonic, super-Alfvénic solar-wind flow, a number of important theoretical extensions have been developed and included in the computational procedures. These include the capability for treating very low oncoming interplanetary gasdynamic Mach numbers ($M_m \approx 2.0$), as well as quite general ionopause shapes. A new family of ionopause shapes has been developed which includes the effect of gravitational variation in scale height, and has been incorporated in the computational program. Additionally, the capability for determining the plasma gasdynamic and magnetic-field properties along any arbitrary spacecraft trajectory, accounting for an arbitrary oncoming direction of the solar wind, has been developed. All of these developments have been incorporated into an assemblage of computer codes to enable detailed calculations of the solar-wind interaction with planetary atmospheres. The computer codes have been extensively documented and are described in a computer user's manual included as part of this report.

Comparisons are reported which verify the correctness of these new procedures, and which demonstrate their capability for computing a wide range of flows encompassing those typical of solar-wind conditions about terrestrial planetary atmospheres. A catalog of sample solar-wind flows covering a large number of flow conditions and ionopause geometries was established, and reported in summary format in the forms of contour plots of important flow-field and magnetic-field properties. Finally, successful comparisons of results from the theoretical model were made with actual spacecraft data obtained from initial orbits of the Pioneer-Venus Orbiter. These results have indicated the importance, heretofor largely neglected, of the directional variability of the oncoming solar wind. All of these results, taken in toto, serve to verify the basic theoretical model which underlies the present procedures. Furthermore, it demonstrates the value of the present computational procedures as a research tool capable of routinely providing - at small computation cost

and in a format directly compatible with experimental observations - details of the solar-wind/planetary atmosphere interaction process not previously attainable.

With regard to future uses as well as improvements of the present model, the obvious need for a detailed study involving comparisons between theory and observations for a large number of orbits of the Pioneer-Venus Orbiter is clear. Based on the preliminary comparisons for orbits 3 and 6, the frozen magnetic-field model appears to be remarkably accurate for relatively quiet-time conditions. Similar comparisons of the plasma properties indicate a need for an improved interpretation of the results from the single-fluid theory in terms of multi-component measurements. Questions regarding the possible suppression by the interplanetary magnetic field of the number of degrees of freedom of the plasma require further study and could be clarified through systematic comparisons with data. Additionally, observations from the Pioneer-Venus Orbiter of the nightside ionosphere of Venus have indicated a more complex and dynamic structure than suspected. These observations point, in particular, toward the need for improvement of the simple model used in the present method for the determination of the ionosphere boundary. This improved determination would involve an iterative procedure in which a balance of the sum of the solar-wind gasdynamic plus magnetic pressure along the ionopause surface would be maintained against the ionospheric pressure. The present method, which balances the Newtonian pressure distribution against the ionospheric pressure, represents the first step in this iteration.

ACKNOWLEDGEMENTS

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APPENDIX A COMPUTER PROGRAM USER'S MANUAL

APPENDIX A

COMPUTER PROGRAM USER'S MANUAL

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APPENDIX A

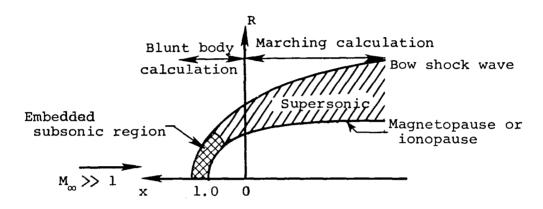
A.1 INTRODUCTION

The purpose of this appendix is to describe the operation of the assemblage of computer codes which were developed in conjunction with the theoretical work presented in this report and organized into one program, and to provide sufficient detail to permit understanding and use of the program. The program computes the flow field of the solar wind about a terrestrial planet, using a procedure for the calculation of supersonic/hypersonic flow about an axisymmetric blunt body. The corresponding frozen-in magnetic field is calculated from the previously-determined velocity and density fields. Streamlines and contour lines of various flow-field properties and magnetic-field components are also determined. Next, these flow-field and magnetic-field values are calculated for points along a user-specified trajectory.

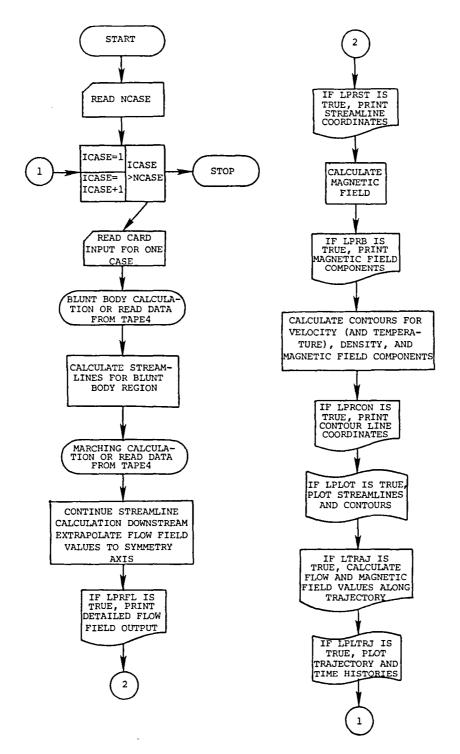
A description of the general operating procedure of the program is given, with descriptions of input and output. The program is written in FORTRAN IV and has been developed on a CDC 7600 computer. University Computing Company (UCC) Standard Plotting Software and Functional Software packages are used to produce automated plots. Files used, besides TAPE5 for INPUT and TAPE6 for OUTPUT, are TAPE1 for the plot file (system default), TAPE4 for input file for rerun option, and TAPE9 for storing data for rerun. Typical run times for cases using the default parameters are 110 to 120 seconds, using the OPT=2 compiler. For a case using the rerun option, which employs a previously-calculated flow field, the run time is approximately 15 seconds. The storage requirements are 146K₈ for small core memory and 273K₈ for large core memory.

A.2 PROGRAM DESCRIPTION

For computational purposes, the flow is subdivided into two regions, as indicated in the sketch below, with the center of the planet as origin.



The region near the nose of the magnetopause/ionopause includes all of the imbedded subsonic flow and part of the supersonic flow. An axisymmetric implicit unsteady Euler equation solver is used to calculate this part of the flow field. Using the solution plane at x = 0.0 to provide starting conditions, the flow field in the purely supersonic downstream region is determined by integrating the steady Euler equations using a spatial-marching procedure. Streamlines, the magnetic field, and contours are calculated using the entire flow field, distinguishing between the two regions as required by the different forms of the computational grids. A rerun capability is provided, where flow-field data is read from a file written on a previous run, rather than repeating the blunt-body and marching calculations. The computations proceed as shown in the sketch below, which provides an overall flow chart of the complete program. The program provides for several cases to be run consecutively.



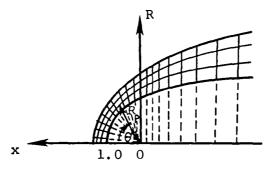
Program Flow Chart

A.2.1 Calculation Procedure

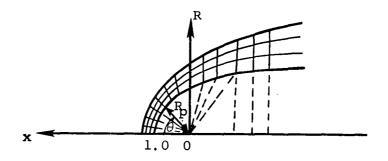
After reading in the number of cases in the run, each case is calculated independently. Subroutine INPUT reads in all card input required for one case, viz. a title, flow conditions, obstacle geometry, calculation and print control parameters, and desired contour values. The user may supply the obstacle geometry in the form of a shape table for an axisymmetric body, or use one of the default shapes which are calculated internally by the program. These default shapes are the magnetopause equatorial trace, constant scaleheight ionopauses, and ionopauses having gravitational variation in scale-height. The input is printed as the first item of output.

A.2.1.1 Blunt-body calculation

A computational mesh in polar (R_p,θ) coordinates is established for the blunt-body calculation; then, for the marching calculation, this is extended into a cylindrical (x,R) system, as indicated below:



This method has proven effective except for certain obstacle shapes which have a significant amount of flaring at the terminator and/or cases involving low free-stream Mach numbers $M_{\infty} \leq 3$. Under such conditions, the axial component of velocity may become subsonic at the starting plane of a marching calculation (terminator) and the calculation cannot proceed. In this case the blunt-body grid must be extended past $\theta = 90^{\circ}$ as shown below:



The number of rays added to the blunt-body mesh is controlled by the input variable NXADD, and are limited by the requirement, NBLUNT + NXADD < 39.

All lengths, x, R, $R_{\rm p}$, are normalized so that the nose of the obstacle is at x = 1.0. For the default shapes, rays at equal angular increments of $\Delta\theta$ are used, starting at $-\Delta\theta/2$, up to 90° + $\Delta\theta$, where $\Delta\theta$ = 90°/(NBLUNT-1.5), and NBLUNT is an input parameter describing the number of angular mesh points to be used in the bluntbody calculation. Program default value is NBLUNT = 24, so that for the default mesh, $\Delta\theta$ = 4°. The obstacle shape is determined by integrating the appropriate differential equation by a trapezoidal predictor-corrector method. For a user-supplied shape, the θ grid is determine by rays from the origin through the first NBLUNT points, and the reflection of the first ray about the x-axis. are determined by dividing the line segments between the body and bow shock wave into NR-1 equal intervals. Thus, including the obstacle and bow shock wave, the grid forms NR arcs around the obstacle. A starting solution for the blunt-body calculation is obtained by guessing a bow shock shape and by prescribing a Newtonian pressure distribution on the body. Noting that the maximum entropy streamline wets the body, other flow properties on the body surface can then be calculated. An initial flow field is then established by linear interpolation between the obstacle and the quessed bow shock, where the Rankine-Hugoniot relations hold. The integration proceeds in time for ITER steps. The initial bow shock shape used for the magnetopause equatorial trace and for an

ionopause with H/R $_{\rm O}$ \geq 0.1 is a correlation shape depending on (M $_{\infty}$, Y, H/R $_{\rm O}$) and given by the parabola R $_{\rm p}$ = $\delta_{\rm 1}\sqrt{\delta_{\rm O}-x}/\sqrt{\delta_{\rm O}}$ where

$$\begin{split} \delta_{O} &= 1.0 + 1.1 \; \{ [(\gamma-1)M_{\infty}^{2} + 2]/(\gamma+1)M_{\infty}^{2} \} \times (0.9 + 0.5 \; \text{H/R}_{O}) \\ \delta_{1} &= \Delta_{O} \; \{ (1.273 + 0.009 \; \text{M}_{\infty}^{2}) \, (0.904 + 0.655 \; \text{H/R}_{O}) \\ & \times \; [3.95 - 5.3 \; \text{H/R}_{O} + 3.85 \; (\text{H/R}_{O})^{2}] \} \; + \; (\text{R}_{body})_{x=0.0} \\ \Delta_{O} &= [(\gamma-1)M_{\infty}^{2} + 2]/[(\gamma+1)M_{\infty}^{2}] \times 0.78 \end{split}$$

For a user-supplied obstacle shape and for an ionopause with $H/R_O < 0.1$, the initial shock shape used is the curve $R_p = \sqrt{[1+\Delta_O(1+0.68~\theta^2+0.16~\theta^4)]}$. Information on convergence, the final sonic line locations, and the body and final bow shock shape are printed from this calculation.

The flow chart for the blunt-body code is shown in Figure A.1(a).

A.2.1.2 Marching calculation

The results at the θ = 90° plane of the blunt-body calculation are used as starting conditions for the marching calculation, after proper variable normalization for the internal marching calculation. For default geometries, the obstacle shape is determined by integration of the appropriate differential equation proceeding from the nose downstream at equal θ increments to form a body-shape table. The stepsize along the x-axis is recalculated at every ICONST(49) with ICONST(49) being set to 10. At each x-location, $R_{\rm body}$ is determined by linear interpolation. The computational mesh is extended by adding the line perpendicular to the x-axis at each step, divided in the same manner as for the blunt nose. The calculation marches downstream with a maximum stepsize of 1.0 until the terminal location specified

by the user has been passed. However, the number of steps is limited to 75, after which the calculation will end regardless of the x-location. The coordinates of the obstacle and bow shock are printed at each step.

The grid coordinates and flow-field values are written to a file, TAPE9, which may be saved to use as input for a later run. This rerun option, which replaces construction of the computational mesh and performance of the blunt-body and marching calculations with the reading of the rerun input file TAPE4, is described in section A.2.2. The flow chart for the marching calculation is provided in figure A.1(b).

A.2.1.3 Streamline calculation

The marching calculation provides (x,R) grid coordinates, and values of density ρ/ρ_{t} , and velocity components v_{X}/v_{t} and v_{R}/v_{t} , where t denotes free-stream stagnation conditions. For compatibility with the blunt-body solution, the flow-field values are converted to ρ/ρ_{∞} , v_{X}/v_{∞} , v_{R}/v_{∞} before calculating the resultant velocity magnitude

 $|v|/v_{\infty}$ and flow angle ϕ . The streamline calculation is continued downstream, employing the same method as in the nose region. Starting positions on the shock wave for the streamline calculation in the marching zone are set at equal R-increments, with a maximum of 50 streamlines calculated. The flow angle is determined using bivariate linear interpolation first in x, then in R.

Along the symmetry axis, values of x, ρ/ρ_{∞} , and $|y|/v_{\infty}$ are determined by extrapolation, using a third-order Lagrangian polynomial in θ on each arc of the computational grid. Exact values for the stagnation streamline are used where possible, viz. at the bow shock

$$\rho/\rho_{\infty} = (\gamma+1)M_{\infty}^{2}/[(\gamma-1)M_{\infty}^{2} + 2]$$
$$|y|/v_{\infty} = 1/(\rho/\rho_{\infty})$$

at the body surface

$$\rho/\rho_{\infty} = (\rho/\rho_{\infty})_{\text{shock}} \cdot \left\{ \left[\left[(\gamma+1)M_{\infty} \right]^{2} / \left[4\gamma M_{\infty}^{2} - 2(\gamma-1) \right] \right]^{1/(\gamma-1)} \right\}$$

$$|\underline{v}|/v_{\infty} = 0.0$$

$$x = 1.0$$

Detailed flow-field output may now be printed by subroutine FLOUT, with LPRFL as print control variable. In addition to grid coordinates, density, velocities and flow angle, values of temperature T/T_{∞} and pressure P/P_{∞} are output, where

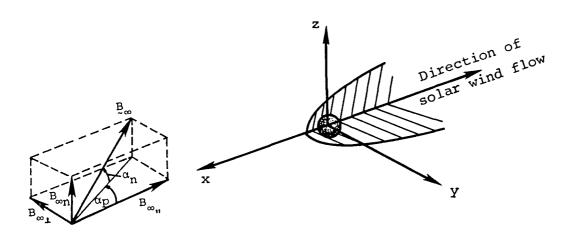
$$T/T_{\infty} = 1 + [(\gamma-1)/2] \cdot M_{\infty}^2 \cdot [1 - (|y|/v_{\infty})^2]$$

$$P/P_{\infty} = (\rho/\rho_{\infty}) (T/T_{\infty})$$

Streamline coordinates may also be printed by subroutine STOUT, with LPRST as print control variable. A plot of the streamlines is generated if the variable LPLOT is true. A flow chart of the streamline calculation is shown in figure A.1(c).

A.2.1.4 Magnetic-field calculation

The magnetic field is determined by separately calculating the unit components whose directions are parallel, perpendicular, and normal to the flow, in the undisturbed solar wind. These components are then added vectorially, the resultant being expressed in orthogonal (x,y,z) components. The angles in the free stream α_p and α_n between the magnetic field and the flow, as shown in the sketch below, are either input or, in the case of a trajectory calculation, are calculated internally from the input interplanetary magnetic field.



The magnetic-field components are calculated using the following formulae in which e signifies a vector of magnitude e in the direction of the component field line, and n the unit normal vector.

$$\left(\frac{\frac{B}{B_{\infty}}}{B_{\infty}}\right)_{\mathbf{I}} = \left(\frac{\underline{\underline{v}}}{v_{\infty}}\right) \left(\frac{\rho}{\rho_{\infty}}\right); \quad \left(\frac{\underline{\underline{B}}}{B_{\infty}}\right)_{\mathbf{I}} = \left(\frac{\Delta \ell}{\Delta \ell_{\infty}}\right) \left(\frac{\rho}{\rho_{\infty}}\right); \quad \left(\frac{\underline{B}}{B_{\infty}}\right)_{\mathbf{I}} = \left(\frac{\underline{R}}{R_{\infty}}\right) \left(\frac{\rho}{\rho_{\infty}}\right)$$

$$\left(\frac{\underline{B}}{B_{\infty}}\right) = \left(\frac{\underline{B}}{B_{\infty}}\right)_{\mathbf{I}} \quad \left(\frac{B_{\infty}}{B_{\infty}}\right) + \left(\frac{\underline{B}}{B_{\infty}}\right)_{\mathbf{I}} \quad \left(\frac{B_{\infty}}{B_{\infty}}\right) + \hat{n} \quad \left(\frac{\underline{B}}{B_{\infty}}\right)_{\mathbf{I}} \quad \left(\frac{B_{\infty}}{B_{\infty}}\right)$$

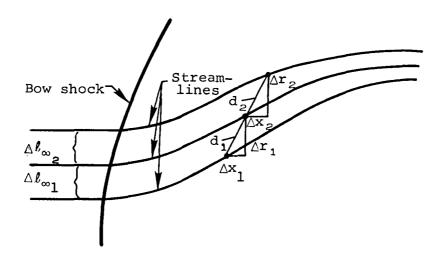
The magnetic-field line vector component B_{μ} which results from the interplanetary component $\mathbf{B}_{\mathbf{\omega_{n}}}$ that is parallel to the undisturbed solar flow has local magnitude given by ($|\underline{y}|/v_{_{\!\infty}})\,(\rho/\rho_{_{\!\infty}})$, and the same local direction ϕ as the fluid flow. Determination of the normal magnetic-field component B_n requires calculation of R/R_{∞} , where R_{∞} is the free-stream cylindrical R-ordinate of the streamline through the point under consideration. This is calculated by linearly interpolating in the local radial cylindrical coordinate R between the streamlines, with $R/R_{\infty} = 1.0$ along the x-axis. The magneticfield vector component Br resulting from the interplanetary component B_{∞} , which is perpendicular to the undisturbed solar-wind flow requires the distance vector $\Delta \ell / \Delta \ell_{\infty}$, whose magnitude is $|\Delta \ell|/\Delta \ell_{\infty}$ and direction is ψ , where $|\Delta \ell|/\Delta \ell_{\infty}$ is the stretching factor of the perpendicular field at the point, and ψ is the direction of the field line through the point. The magnitude and direction of $\Delta \underline{\ell}/\Delta \ell_{\infty}$ are calculated according to

$$\frac{|\Delta \ell|}{\Delta \ell_{\infty}} = \frac{d_1 \cdot d_2}{d_1 + d_2} \cdot \frac{1}{\Delta \ell_{\infty_1} + \Delta \ell_{\infty_2}}$$

and

$$\psi = \frac{\tan^{-1} \left(\frac{\Delta r_1}{\Delta x_1}\right) \cdot d_2 + \tan^{-1} \left(\frac{\Delta r_2}{\Delta x_2}\right) \cdot d_1}{(d_1 + d_2)}$$

where the quantities d_1 , d_2 , Δx_1 , Δx_2 , Δr_1 , Δr_2 , $\Delta \ell_{\infty 1}$, and $\Delta \ell_{\infty 2}$ are described by the sketch below. The points marked (•) on the streamlines represent equal-time intervals in the flow.



$$(|\Delta \ell|/\Delta \ell_{\infty})^{2} = 1 + \cot^{2}\theta (1+D^{2}) - 2D \times \csc\theta \times \cot\theta \times \cos(\theta-\delta)$$

$$\psi = \theta + \sin^{-1}[D \times \cot\theta \times \sin(\theta-\delta)/(|\Delta \ell|/\Delta \ell_{\infty})]$$

where

$$D^{2} = 1 - 4(M_{\infty}^{2}\sin^{2}\theta - 1)(\gamma M_{\infty}^{2}\sin^{2}\theta + 1)/[(\gamma + 1)^{2}M_{\infty}^{4}\sin^{2}\theta]$$

$$\cot \delta = \tan\theta \times \{(\gamma + 1)M_{\infty}^{2}/[2(M_{\infty}^{2}\sin^{2}\theta - 1)] - 1\}$$

$$\theta = \tan^{-1}\left[\frac{dR_{\text{shock}}}{dx}\right]$$

The values of $|\Delta \ell|/\Delta \ell_{\infty}$ at the grid points are smoothed using fifth-order least-squares fit with respect to arc length along the arcs of th grid. The resultant magnetic field can then be expressed in orthogonal (x,y,z) components. The code determines these components for the case when the field point is located in the (x,y) plane, i.e., z=0. These components are given by

$$B_{x}/B_{\infty} = \cos \alpha_{n} \times [\cos \phi \times \cos \alpha_{p} \times (|\underline{B}|/B_{\infty})_{n} + \cos \psi \times \sin \alpha_{p} \times (|\underline{B}|/B_{\infty})_{1}]$$

$$B_{y}/B_{\infty} = \cos \alpha_{n} \times [\sin \phi \times \cos \alpha_{p} \times (|\underline{B}|/B_{\infty})_{n} + \sin \psi \times \sin \alpha_{p} \times (|\underline{B}|/B_{\infty})_{1}]$$

$$B_{z}/B_{\infty} = \sin \alpha_{n} \times (B/B_{\infty})_{n}$$

Magnetic-field components may now be printed by subroutine BOUT, with LPRB as print control parameter. The magnetic field is not calculated when LPRB = .FALSE. and KBCON=0. A flow chart of the magnetic-field calculation is shown in figure A.1(d).

A.2.1.5 Contour calculation and plot generation

Contours are calculated for velocity $|v|/v_{\infty}$, density ρ/ρ_{∞} , and magnetic components $(|B|/B_{\infty})_{n}$, $(|B|/B_{\infty})_{1}$, and $(|B|/B_{\infty})_{n}$. The method used is a modified version of a procedure developed by R. Sorenson

of NASA/Ames Research Center. The boundary is searched for intervals which bracket a contour point. Having found one point, the remainder of the contour is determined by 'walking' around the contour, searching at each step for the interval through which the contour line next passes, until a boundary point is reached. Then closed contours are found in a similar manner. Linear interpolation is used throughout the process. Note that since T/T_{∞} is a function of $|v|/v_{\infty}$ only, velocity contours may also be considered as temperature contours. Temperature and velocity are related by the following function.

$$T/T_{\infty} = 1 + \frac{\gamma - 1}{2} M_{\infty}^{2} \left[1 - \left(\frac{|y|}{v_{\infty}} \right)^{2} \right]$$

The coordinates of the contour lines can be printed by subroutine CONOUT, with LPRCON as print control parameter.

The program segment which controls the generation of contour plots is accessed only when LPLOT = .TRUE. The UCC Plot Routines used to produce these plots are AXIS, CHAR, DASH, DOTLN, ENPLT, GREEK, MATH, NUMPLT, PLOT, PLTLN, POLAR, RESET, SCALF, and VECTOR. A flow chart of the contour calculation and plot generation in figure A.1(e).

A.2.1.6 Trajectory calculation

This segment of the program provides theoretical plasma and magnetic-field properties in an output form that is useful for direct comparison with actual spacecraft data. Given a sequence of coordinates describing the spacecraft trajectory, the program calculates the density, temperature, and velocity and magnetic-field components at each point. Generation of trajectory plots is controlled by the logical variable LPLTRJ. The trajectory calculation proceeds as follows.

Input to this calculation includes interplanetary values of temperature, density, velocity, and magnetic field together with

the trajectory coordinates. The trajectory input is required as a function of time and normalized by planetary radius. If the logical variable LSUN is TRUE, then it is assumed that the trajectory coordinates and vector quantities are expressed in terms of a sun-planet (ecliptic) coordinate system. In this case, these quantities are converted by the program into a solar-wind coordinate system by the transformation

$$\begin{bmatrix} x_{w} \\ y_{w} \\ z_{w} \end{bmatrix} = \begin{bmatrix} \cos \Omega \cos \phi_{p} & -\sin \Omega \cos \phi_{p} & \sin \phi_{p} \\ \sin \Omega & \cos \Omega & 0 \\ -\cos \Omega \sin \phi_{p} & \sin \Omega \sin \phi_{p} & \cos \phi_{p} \end{bmatrix} \begin{bmatrix} x_{s} \\ y_{s} \\ z_{s} \end{bmatrix}$$

where (x_w, y_w, z_w) are coordinates in the solar-wind system and (x_s, y_s, z_s) are coordinates in the sun-planet system. The angles Ω and ϕ_p are the azimuthal (total aberration) and polar angles, respectively. The azimuthal angle, Ω , is the angle in the plane of the ecliptic between the sun-planet line and the oncoming solar-wind, i.e., the x_s -axis and the x_w -axis as shown in figure A.2. The angle ϕ_p , positive for southward solar-wind flow, measures the deviation of the solar-wind from the plane of the ecliptic. Figure A.2 illustrates the transformation from sun-planet ecliptic coordinates to solar-wind coordinates. In this case the azimuthal and polar angles indicated are both positive.

If LSUN is FALSE, it is assumed that all input data are referenced to the solar-wind coordinate system and this transformation is not performed.

In order to conform with the internal flow-field and magnetic-field calculations, the signs of the x and y components of the trajectory and vector quantities are reversed. This is, in effect, another coordinate transformation which is defined by

$$\begin{bmatrix} \mathbf{x}_{\mathbf{C}} \\ \mathbf{y}_{\mathbf{C}} \\ \mathbf{z}_{\mathbf{C}} \end{bmatrix} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 1 & 0 & 1 \end{bmatrix} \begin{bmatrix} \mathbf{x}_{\mathbf{w}} \\ \mathbf{y}_{\mathbf{w}} \\ \mathbf{z}_{\mathbf{w}} \end{bmatrix} = \begin{bmatrix} -\cos \alpha \cos \phi_{\mathbf{p}} & -\sin \alpha \cos \phi_{\mathbf{p}} & \sin \phi_{\mathbf{p}} \\ \sin \alpha & -\cos \alpha & 0 \\ -\cos \alpha \sin \phi_{\mathbf{p}} & \sin \alpha \sin \phi_{\mathbf{p}} & \cos \phi_{\mathbf{p}} \end{bmatrix} \begin{bmatrix} \mathbf{x}_{\mathbf{s}} \\ \mathbf{y}_{\mathbf{s}} \\ \mathbf{z}_{\mathbf{s}} \end{bmatrix}$$

where (x_C, y_C, z_C) are coordinates referenced to the internal calculation system. This transformation is illustrated in figure A.3. Also shown in figure A.3 is the relationship of the interplanetary parallel, perpendicular, and normal magnetic field components to the internal calculation system. Specifically,

$$B_{\infty_{\parallel}} = B_{X_{C}}, B_{\infty_{\perp}} = B_{Y_{C}}, \text{ and } B_{\infty_{n}} = B_{Z_{C}}$$

The angles $\alpha_{_{D}}$ and $\alpha_{_{D}}$ are now calculated from the relationships

$$\alpha_{p} = \tan^{-1} \left(\frac{B_{y_{c}}}{B_{x_{c}}} \right)$$

and

$$\alpha_{n} = \tan^{-1} \left[\frac{B_{y_{c}}}{\sqrt{(B_{x_{c}})^{2} + (B_{y_{c}})^{2}}} \right]$$

At this point, all data is in a form compatible with the internal calculations and the program can interpolate for flow and magnetic-field values along the trajectory. The following procedure is repeated at each trajectory point. Noting that the flow is axisymmetric, the coordinate system may be rotated to the most convenient orientation for the calculation. The present (x_C, y_C, z_C) coordinates are converted to (x_C, R) coordinates by a rotation in the (y_C, z_C) plane about the x_C -axis through the angle $\theta = \tan^{-1}[z_C/y_C]$. This rotation defines a new coordinate system (x', y', z') in which z' = 0. Subroutine IJRAJ now locates the point with reference to the computational flowfield grid. The point is either within the ionopause, in the grid

region, or beyond the bow shock. If the point is within the ionopause, all values are set to zero. If the point lies beyond the bow shock, all quantities assume their free-stream values. For points within the grid, the velocity magnitude, density, and flow angle ϕ are found by interpolation using function FTRAJ. From the flow angle ϕ and the rotation angle θ , velocity components in the (x_C, y_C, z_C) system can be calculated according to

$$v_{x_C} = v\cos \phi$$

$$v_{y_C} = v\sin \phi \cos \theta$$

$$v_{z_C} = v\sin \phi \sin \theta$$

Calculation of the magnetic field is complicated somewhat because the components are dependent on the incident magnetic field. Using α_p and α_n , $B_{x_\infty}^{,}$, $B_{y_\infty}^{,}$, and $B_{z_\infty}^{,}$ are calculated in the rotated (x',y',z') system by

$$B_{\mathbf{x}_{\infty}}^{\bullet} = B_{\mathbf{x}_{\mathbf{C}_{\infty}}}$$

$$B_{\mathbf{y}_{\infty}}^{\bullet} = B_{\mathbf{y}_{\mathbf{C}_{\infty}}} \cos \theta + B_{\mathbf{z}_{\mathbf{C}_{\infty}}} \sin \theta$$

$$B_{\mathbf{z}_{\infty}}^{\bullet} = -B_{\mathbf{y}_{\mathbf{C}_{\infty}}} \sin \theta + B_{\mathbf{z}_{\mathbf{C}_{\infty}}} \cos \theta$$

Then $\alpha_p^{\, \text{\tiny I}}$ and $\alpha_n^{\, \text{\tiny I}}$ are defined by

$$\alpha_{p}^{\prime} = \tan^{-1} \left(\frac{B_{y_{\infty}}^{\prime}}{B_{x_{\infty}}^{\prime}} \right) \text{ and } \alpha_{n}^{\prime} = \tan^{-1} \left[\frac{B_{z_{\infty}}^{\prime}}{\sqrt{(B_{x_{\infty}}^{\prime})^{2} + (B_{y_{\infty}}^{\prime})^{2}}} \right]$$

Interpolation is then carried out to determine the magnetic angle ψ and the ratios $\left|\frac{B}{B_{\infty}}\right|_{\text{I}}$, $\left|\frac{B}{B_{\infty}}\right|_{\text{I}}$, and $\left(\frac{B}{B_{\infty}}\right)_{\text{I}}$ in the rotated system again using the function FTRAJ. Next, the magnetic-field components B_{X}^{I} , B_{Y}^{I} , B_{Z}^{I} in the rotated system are calculated from

$$B_{\mathbf{x}}' = \cos \alpha_{\mathbf{n}}' \left[\cos \phi \cdot \cos \alpha_{\mathbf{p}}' \cdot \left| \frac{B}{B_{\infty}} \right|_{\mathbf{n}} + \cos \psi \cdot \sin \alpha_{\mathbf{p}}' \cdot \left| \frac{B}{B_{\infty}} \right|_{\mathbf{I}} \right] \cdot B_{\infty}$$

$$B_{y}' = \cos \alpha_{n}' \left[\sin \phi \cdot \cos \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{n} + \sin \psi \cdot \sin \alpha_{p}' \cdot \left| \frac{B}{B_{\infty}} \right|_{1} \right] \cdot B_{\infty}$$

$$B_{z}^{\prime} = \sin \alpha_{n}^{\prime} \cdot \left(\frac{B}{B_{\infty}}\right)_{n} \cdot B_{\infty}$$

Finally, these magnetic-field components are rotated back through the angle θ to yield magnetic-field components referenced to the internal calculation system $(x_C^{},y_C^{},z_C^{})$ by

$$\begin{bmatrix}
B_{\mathbf{x}_{\mathbf{C}}} \\
B_{\mathbf{y}_{\mathbf{C}}} \\
B_{\mathbf{z}_{\mathbf{C}}}
\end{bmatrix} = \begin{bmatrix}
1 & 0 & 0 \\
0 & \cos \theta & -\sin \theta \\
0 & \sin \theta & \cos \theta
\end{bmatrix} \begin{bmatrix}
B_{\mathbf{x}}^{\dagger} \\
B_{\mathbf{y}}^{\dagger} \\
B_{\mathbf{z}}^{\dagger}
\end{bmatrix}$$

Subroutine TROUT now prints the trajectory output in both the solar-wind (x_C, y_C, z_C) and the sun-planet (x_S, y_S, z_S) coordinate systems using the transformation below to obtain sun-planet magnetic-field vector components from solar-wind magnetic-field vector components.

$$\begin{bmatrix} \mathbf{B}_{\mathbf{x}_{\mathbf{S}}} \\ \mathbf{B}_{\mathbf{y}_{\mathbf{S}}} \\ \mathbf{B}_{\mathbf{z}_{\mathbf{S}}} \end{bmatrix} = \begin{bmatrix} -\cos \alpha \cos \phi_{\mathbf{p}} & \sin \alpha & -\cos \alpha \sin \phi_{\mathbf{p}} \\ \sin \alpha \cos \phi_{\mathbf{p}} & -\cos \alpha & \sin \alpha \sin \phi_{\mathbf{p}} \\ \sin \phi_{\mathbf{p}} & 0 & \cos \phi_{\mathbf{p}} \end{bmatrix} \begin{bmatrix} \mathbf{B}_{\mathbf{x}_{\mathbf{C}}} \\ \mathbf{B}_{\mathbf{y}_{\mathbf{C}}} \\ \mathbf{B}_{\mathbf{z}_{\mathbf{C}}} \end{bmatrix}$$

The transformation of the solar-wind velocity components $(v_{x_C}, v_{y_C}, v_{z_C})$ into sun-planet components $(v_{x_S}, v_{y_S}, v_{z_S})$ is also done using the same transformation.

Finally, if LPLTRJ is true, a file of trajectory plots is created. A flow chart for this program segment is shown in figure A.l(f).

A.2.2 Rerun Option

The rerun option is used when LRERUN = .TRUE. The blunt-body and marching calculations are replaced with the reading of grid coordinates and flow-field values from the rerun file, TAPE4, which contains data written to TAPE9, then saved, on a previous run. Different values for any parameter not used in the flow-field calculations may be specified, viz. contour values, plot length, magnetic-field angles, and output options. Values of AMACH, GAMMA, and HRO are required input, to ensure that the input rerun file does contain the case desired for rerun. If the geometry is user-supplied, the body-shape table will be read from TAPE4, and should not be input from cards.

After reading the card input, MACH, GAMMA, and HRO are tested against values from TAPE4. The grid coordinates and flow-field values from the blunt-body calculation are read in, then smoothed, and streamlines calculated for this region, as previously described. The results of the marching calculation are then read, and the streamline calculation continued downstream. The calculations then proceed as described in section A.2.1.

A run must not contain more than one case which uses the rerun option.

A.2.3 Program Limitations and Precautions

The program makes some assumptions about the geometry of the obstacle shape around which flow is to be calculated, and about the

flow field. The obstacle shape is assumed to be monotonically increasing in cylindrical radius R, going downstream. The nose of the obstacle is at x=1.0. The origin of the (x,R) coordinate system is the center of the planet. Obstacle shapes with sharp corners should be avoided. In the magnetic-field calculation, the first streamline is assumed to be inside the arc described by the grid points immediately off the body, downstream of x=0.0. To reduce computational costs, a grid using NR=10 may be used, in which case a lower value of CN may be required. This would reduce the running time by approximately 40 percent. A free-stream Mach number less than 2.0 is not advised.

A.2.4 Convergence Criteria for BluntaBody Calculation

The output provides two measures of the convergence of the blunt-body calculation. The RMS of shock speed and maximum shock speed are printed at each iteration. These quantities should both tend to zero as the iterations proceed. A value for q_{RMS} , RMS of shock speed, of

$$q_{RMS} < \sqrt{\gamma} \times M_{\infty} \times 10^{-3}$$

where γ is the specific heat ratio, and M_{∞} is the free-stream Mach number, usually indicates a converged solution. The RMS of error in enthalpy, HT, should be less than 1 percent, with the maximum enthalpy error also of that order.

The Courant number, CN, determines the time step size used by the calculation. A value not greater than the default of 3.0 should be used. For low Mach numbers or a coarser mesh than the default grid, a lower value may be preferable. If the default value does not generate a converged solution, or if the error message from subroutine SHOCK is printed, try lowering CN in increments of 0.5 to find a better value of CN. User-supplied bodies may also require a lower Courant number.

A.3 DESCRIPTION OF INPUT

This section describes the card input for the program. An alphabetized dictionary of input variables is provided, defining the varibles, listing default values and limitations. A discussion of the preparation of the card input is then presented, followed by a description of the input card format.

A.3.1 Dictionary of Input Variables

AMACH free-stream Mach number; 3.0 < AMACH < 25.0 is recommended

ANGN the angle, in degrees, measuring the deviation of the free-stream magnetic field from the plane in which \mathbb{B}_{∞} and \mathbb{B}_{∞} lie; equal to $\tan^{-1}\left(\mathbb{B}_{\infty}/\sqrt{\left|\mathbb{B}_{\infty}^{2}\right|}+\left|\mathbb{B}_{\infty}^{2}\right|\right)$; see figure A.3, measured in the $(\mathbf{x_{C}},\mathbf{y_{C}},\mathbf{z_{C}})$ coordinate system; only specified when interplanetary magnetic-field components not specified.

ANGP the angle, in degrees, measuring the deviation of the inplane magnetic component $(B_{\infty_{\parallel}} + B_{\infty_{\perp}})$ from the direction of flow; equal to $\tan^{-1}(B_{\infty_{\parallel}}/B_{\infty_{\perp}})$; see figure A.3, measured in the (x_C, y_C, z_C) coordinate system; only specified when interplanetary magnetic-field components not specified.

AZANG angle in the ecliptic plane between the sun-planet line and the direction of solar-wind flow. See figure A.2 for positive direction.

BCON(I) KBCON-dimensional array specifying values to be used for magnetic field strength contours

BINF magnetic field strength free-stream value; set to 1.0 if plots desired in nondimensionalized units.

BX1 x_s-component of interplanetary magnetic field; referred to sun-planet coordinates

BY1 y_s-component of interplanetary magnetic field; referred to sun-planet coordinates

BZl z_s-component of interplanetary magnetic field; referred to sun-planet coordinates

CN Courant number used for blunt-body calculation; program default value is 3.0

GAMMA ratio of plasma specific heats

HRO obstacle geometry indicator:

 $HRO > 0. - ionopause with H/R_O = HRO$

HRO = 0. - magnetopause equatorial trace

HRO < 0. - geometry is user-supplied

integer, number of iterations for blunt-body calculation;
program default value is 300

KBCON integer, number of values specified for magnetic-field contours; $0 \le \text{KBCON} \le 20$

KRCON integer, number of values specified for density contours; 0 < KRCON < 20

KVCON integer, number of values specified for velocity magnitude contours; $0 \le \text{KVCON} \le 20$

LGRAV logical variable indicating whether default ionopause is calculated with gravitational variation in scale height

FALSE - no TRUE - yes LPLOT logical variable indicating whether to create plots or plot file

FALSE - no

TRUE - yes

LPLTRJ logical variable indicating whether to create trajectory and time history plots

FALSE - no

TRUE - yes

LPRB logical variable indicating whether to print magnetic field output

FALSE - no

TRUE - yes

LPRCON logical variable indicating whether to print coordinates of contours lines

FALSE - no

TRUE - yes

LPRFL logical variable indicating whether to print detailed flow-field output

FALSE - no

TRUE - yes

LPRST logical variable indicating whether to print coordinates of streamlines

FALSE - no

TRUE - yes

LRERUN logical variable indicating whether this case uses rerun option

FALSE - perform blunt-body and marching calculations

TRUE - read results of a previous calculation from TAPE4

LRSTRT logical variable indicating whether to use previous shock shape as initial guess for blunt body

TRUE - use shock shape from previous solution.

(Must have a full solution as an earlier run in same job.)

FALSE - use default initial guess for shock shape

LSUN logical variable indicating whether trajectory input is referenced to sun-planet coordinate system

FALSE - trajectory input in solar-wind coordinates
TRUE - trajectory input in sun-planet coordinates

LTRAJ logical variable indicating whether to perform a trajectory calculation

TRUE - trajectory calculation, data provided FALSE - no trajectory calculation

MARKT(I) NMARKT - dimensional array specifying points to be marked for cross reference. If K = NMARKT(I), the Kth point of the trajectory is to be marked.

NBLUNT integer, number of angular mesh points for blunt-body calculation; for user-supplied geometry, XX(NBLUNT-1)=0.0; program default value, and maximum, is 24

NBOD integer, number of points in body-shape table when geometry is user-supplied; 1 < NBOD < 100

NCASE integer, number of cases to be run consecutively; NCASE > 1

NMARKT integer, numbered values specified for cross reference points; 0 < NMARKT < 12.

NR integer, number of radial mesh points; program default value, and maximum, is 19

NTRAJ integer, number of points specified in trajectory table

NXADD integer, number of points to be added to blunt-body grid past $\theta = 90^{\circ}$, default value is 0.

POLANG angle, measured in degrees, between the plane of the ecliptic and direction of solar-wind flow; positive for southward flow; see figure A.2

RCON(I) KRCON - dimensional array specifying values to be used for density contours

RHOINF density-free stream value; set to 1.0 if plots desired in nondimensional units

RPLNT radius of planet in units of nose radius, R_{PLNT}/R_{O}

RR(I) NBOD - dimensional array representing the R-locations, in cylindrical (x,R) coordinates, of the user-supplied body shape; in units of nose radius

TITLE descriptive heading of the case, to be printed on the first page of output; may contain up to 80 characters, including blanks

TMPINF free-stream temperature; set to 1.0 if plots desired in nondimensional units

TTRAJ(I) NTRAJ - dimensioned array specifying time locations of trajectory points

VCON(I) KVCON - dimensional array specifying values to be used for velocity contours

- VINF free-stream velocity; set to 1.0 if plots desired in nondimensional units
- XCALC terminal downstream x-location for marching calculation of flow field; XCALC < 0.0; program default value is -1.0
- XPLOT terminal downstream x-location for calculation of streamlines, magnetic field, and contours; XCALC \leq XPLOT \leq 0.0; program default value is -1.0
- XTRAJ(I) NTRAJ dimensioned array specifying x_s -locations of trajectory points; in units of planetary radius; when (ANGP,ANGN) are specified, XTRAJ(I) is referred to solar-wind x_c -locations; see figures A.2 and A.3
- XX(I) NBOD dimensional array representing the x-locations, in cylindrical (x,R) coordinates, of the user-supplied body shape; in units of nose radius. See figures A.2 and A.3
- YTRAJ(I) NTRAJ dimensioned array specifying y_s -locations of trajectory points; in units of planetary radius; when (ANGP,ANGN) are specified, YTRAJ(I) is referred to solar-wind y_c -locations; see figures A.2 and A.3
- ZTRAJ(I) NTRAJ dimensioned array specifying z_S -locations of trajectory points; in units of planetary radius; when (ANGP,ANGN) are specified, ZTRAJ(I) is referred to solar-wind z_C -locations; see figures A.2 and A.3

A.3.2 Preparation of Input Data

The card input for a run consists of one card containing the number of cases to be run consecutively, Item 0, followed by a set of input for each case, Item 1 through Item 7, and Item 8 if required. Where a default value is to be used, the input field should be left blank.

For each case, all required variables which do not assume their default values should be specified. The input format for all cards is described in section A.3.3.

Item 0 - This item consists of one card, containing the number of cases in this run, NCASE.

Item 1 - This card provides identification of the case, TITLE, which is printed on the first page of the output for this case.

Item 2 - This card contains information on the flow conditions and body geometry, and parameters required for the blunt-body and marching calculations. AMACH, GAMMA, and HRO must be specified for each case. For the rerun option, the values are tested against the values from the rerun file. The parameters XCALC, NR, NBLUNT, CN, ITER are used only when the flow field is to be calculated. These variables each assume a default value if the input field is blank.

Item 3 - This item consists of one card containing the rerun indicator, LRERUN, the output control variables LPRFL, LPRST, LPRCON, LPRB, and LPLOT, the trajectory indicator LTRAJ, and the restart indicator LRSTRT.

Item 4 - This card contains the variables XPLOT, ANGP, ANGN, NXADD, and LGRAV. The value for XPLOT is changed by the program to be the x-location of the marching calculation immediately upstream of the input value for XPLOT. The angles describing the deviation of the magnetic field from the flow, ANGP and ANGN, are not required when LPRB = .FALSE; KBCON = 0, and LTRAJ = .FALSE. since the magnetic field is not calculated under these conditions. ANGP is the angle between the vectors $(B_{\infty} + B_{\infty})$ and V_{∞} , while ANGN is the angle between B_{∞} and $B_{\infty} + B_{\infty}$, where B_{∞} , B_{∞} , B_{∞} are the components of the freestream magnetic field, B_{∞} , which are parallel, perpendicular, and normal to V_{∞} , and are as indicated in figure A.3. The two angles ANGP and ANGN fully determine the half plane for which the magnetic field

is to be calculated. The magnetic field for the other half of the plane may be calculated by rerunning with the sign of ANGP reversed. When $(B_{\infty} + B_{\infty}) = 0$, ANGN $= \pm 90^{\circ}$, ANGP $= 0^{\circ}$; and, when $B_{\infty} = 0$, ANGN $= 0^{\circ}$. Note that ANGP and ANGN are referenced to the $(x_{\text{C}}, y_{\text{C}}, z_{\text{C}})$ system and are specified only when the interplanetary magnetic-field components are not specified.

If both LTRAJ = .TRUE. and LSUN = .TRUE., then ANGP and ANGN are calculated internally from the interplanetary magnetic-field components BX1, BY1, and BZ1.

Item 5 - This item contains the values for the velocity contours. The first card contains KVCON, the number of values specified for VCON. If KVCON > 0, the contour values are then read. Up to three cards may be required to accommodate the values, eight per card, maximum of 20. The contour values should be monotonically increasing, with at least one value within the range of the magnitude of the velocity in the region for which contours are to be calculated.

Item 6 - This item contains the values for the density contours. The description is similar to that for Item 5, with KRCON being the number of values specified, and RCON the array of values.

Item 7 - This item contains the values for the magnetic-field contours. The description is similar to that for Item 5, with KBCON being the number of values specified, and BCON the array of values. Note that the same contour values are used for the parallel and perpendicular components.

Item 8 - This optional item is required when HRO < 0.0 and LRERUN = .FALSE., and contains the body-shape table for the user-supplied geometry. The first card contains NBOD, the number of points in the shape table. The next NBOD cards contain the cylindrical (x,R) coordinates of these points, [XX(I), RR(I)], one point per card. The points supplied by the user determine the θ -spacing of the mesh used for the

blunt-body calculation. The first point should be near, but not on, the x-axis. A suggested location is such that the θ -spacing between the first point and the x-axis is half the θ -spacing between the first two points. The blunt-body calculation adds a point which is the reflection about the x-axis of the first point in the body-shape table. The (NBLUNT-1) th point should be at x = 0.0. The BLUNT point is also used to create the grid for the blunt-body calculation. The coordinates must be normalized so that the planet center is at (0.,0.) and the nose of the body at (1.,0.).

Item 9 - This optional item is read only when LTRAJ is TRUE. The first card contains NTRAJ, the number of points in the trajectory. Then follows NTRAJ cards, each containing the time T, and location (x_s , y_s , z_s) of one point. The time values should be monotonically increasing. At present, NTRAJ \leq 100 is required. Note that when ANGP and ANGN are specified, the trajectory is specified in (x_c , y_c , z_c) coordinates.

Item 10 - This item is ready only when LTRAJ is TRUE. The variable LPLTRJ indicates whether plots are to be produced of the trajectory and time histories. The relative size of the planet to the ionopause is given by RPLNT, which may be 0.0, in which case, a value of 1.0 is assumed in the calculations, but the planet is not drawn on the plots. Next are the four free-stream values v_{∞} , T_{∞} , ρ_{∞} , P_{∞} . If the plots are desired to be in nondimensional units, any or all of these values may be input as 1.0. Each quantity must have a value, zero is not permissible.

Item 11 - This item is read only when LTRAJ is TRUE. The first card contains NMARKT, the number of values specified for MARKT, (presently maximum of 12). If NMARKT = 0, only this card is required. If NMARKT > 0, the values of MARKT are read, 8 per card.

Item 12 - This item, which includes the variables LSUN, AZANG, POLANG, BX1, BY1, and BZ1, is read only when LTRAJ is true.

A.3.3 Format of Input Data

Four format types are used for the input data. For real numbers (F-format), a decimal point is required. Integers (I-format) should be right-adjusted in the field. For logical variables (L-format), the first non-blank character in the field, which should be 'T' or 'F', determines the value. Note that a blank input field is interpreted as 'FALSE'. The title, which is in A-format, may contain any valid character.

A description of the card format of the input data follows, with item numbers corresponding to those in section A.3.2:

Item No. 0: 1 card

Variable	NCASE
Card Column	10
Format type	I

Item No. 1: 1 card

Variable	Title
Card Column	80
Format type	A

Item No. 2: 1 card

Variable	AMACH	GAMMA	HRO	XCALC	NR	NBLUNT	CN	ITER
Card column	10	20	30	40	50	60	70	80
Format type	F	F	F	F	F	F	F	F

Item No. 3: 1 card

Variable	LRERUN	LPRFL	LPRST	LPRCON	LPRB	LPLOT	LTRAJ	LRSTRT
Card column	10	20	30	40	50	60	70	80
Format type	L	L	L	L	L	L	L	L

Item No. 4: 1 card

Variable	XPLOT	ANGP	ANGN	NXADD	LGRAV
Card column	10	20	30	40	50
Format type	F	F	F	N	L

Item No. 5: a) 1 card

Variable	KVCON
Card column	10
Format type	I

b) 0 to 3 cards as needed for up to 20 values, 8 per card

Variable	VCON(1)	VCON(2)			VCON (KVCON)			
Card column	10	20	30	40	50	60	7 0	80
Format type	F	F	F	F	F	F	F	F

Item No. 6: a) 1 card

Variable	KRCON
Card column	10
Format type	I

b) 0 to 3 cards

Variable	RCON(1)	RCON(2)			RCON (KRCON)			
Card column	10	20	30	40	50	60	70	80
Format type	F	F	F	F	F	F	F	F

Item No. 7 a) 1 card

Variable	KBCON
Card column	10
Format type	I

b) 0 to 3 cards

Variable	BCON(1)	BCON(2)			BCON (KBCON)			
Card column	10	20	30	40	50	60	7 0	80
Format type	F	F	F	F	F	F	F	F

Item No. 8 a) 1 card (this item required only when HRO < 0.0 and LRERUN = .FLASE.)

Variable	NBOD
Card column	10
Format type	I

b) NBOD cards

XX(I)	RR(I)
10	20

Item No. 9: a) 1 card (this item read only when LTRAJ is TRUE)

Variable
Card column
Format type

_	NTRAJ	
		10
	I	
_		_

b) NTRAJ cards

Variable Card column Format type

TTRAJ(I)	XTRAJ(I)	YTRAJ(I)	ZTRAJ(I)
10	20	30	40
F	F	F	F

Item No. 10: 1 card (this item read only when LTRAJ is TRUE)

Variable Card column Format type

LPLTRJ	RPLNT	VINF	RHOINF	TMPINF	BINF
10	20	30	40	50	60
L	F	F	F	F	F

Item No. 11: a) 1 card (this item read only when LTRAJ is TRUE)

Variable
Card column
Format type

NMARKT	
	10
I	

b) 0-2 cards

Variable Card column Format type

MARKT(1)	MARKT (2)			MARKT (NMARKT			
10	20	30	40	50	60	70	80
I	I	I	I	I	I	I	I

Item No. 12: 1 card (this item read only when LTRAJ is TRUE)

Variable Card column Format type

LSUN	AZANG	POLANG	BX1	BYl	BZ1
10	20	30	40	50	60
L	F	F	F	F	F

A.4 DESCRIPTION OF OUTPUT

This section describes the output of the computer program. The contents of each output item are specified and discussed. The printed output consists of seven items, five of which are optional and are controlled with input parameters. Plotted output is also optional.

The first output item consists of a banner page and the input data. The input is presented in two forms: first, as images of the input cards, and then with identification of each variable. Default values are printed as if they were input. Parameters CN, NR, NBLUNT, ITER for the blunt-body calculation and XCALC, the terminal location for the marching calculation, are printed only when the flow field is to be calculated. When the obstacle geometry is user-supplied, the input body-shape table is printed. For a default geometry, the body shape is indicated by the description "default ionopause shape for constant scale height with H/RO = ", or "default ionopause shape with gravitational variation in scale height, H/RO = ". Trajectory input is printed only when LTRAJ is true.

The second output item is not printed when LRERUN = .TRUE. From the blunt-body calculation, the shock speed at each iteration, the final enthalpy error, final sonic-line location, and body and final bow-shock shape are printed. For the marching calculation, the down-stream x-location and body and shock ordinates are output. There is no control variable allowing the user to suppress this item of output when the flow field is calculated.

Detailed flow-field output is the third item, and is printed only when LPRFL = .TRUE. Coordinates are labeled as X/D, R/D, RP/D, or X/RO, R/RO, RP/RO, to emphasize that distances are normalized by the distance from the center of the planet to the nose of the body, D for the magnetopause, RO for an ionopause. Along the symmetry axis, the values printed are velocity magnitude V/VINF, density RHO/RHOINF,

temperature T/TINF, and pressure P/PINF. Over the rest of the flow field, values are also given for velocity components VX/VINF, VR/VINF, and flow angle ϕ . Note that the flow angle is the deviation of the flow about the obstacle, and so $0^{\circ} \leq \phi \leq 90^{\circ}$.

The next output item is the (x,R) coordinates of the streamlines. For blunt-body region, the (R_p,θ) coordinates of the starting position on the bow shock wave are also given. This item is printed only when LPRST = .TRUE.

The magnetic-field components are then printed, if LPPRB = .TRUE. The location of each point is defined in (R_p,θ) coordinates for the blunt-body region, and (x,R) coordinates for the downstream marching region. The components along field lines parallel, perpendicular, and normal to the flow in the free stream are printed as B/BINF(PARALLEL), B/BINF(PERP), B/BINF(NORMAL). The orthogonal (x_c,y_c,z_c) components of the resultant are printed as BX/BINF(RESULTANT), BY/BINF (RESULTANT), BZ/BINF(RESULTANT). The magnetic field in the symmetry (x_c,y_c) plane, defined by the vector sum $[(B/B_{\infty})_{\parallel} + (B/B_{\infty})_{\perp}]$, is also printed, and is given by the magnitude B/BINF(IN-PLANE) and direction B-ANGLE(IN-PLANE) of the vector. We note, as pointed out in the text, that the orthogonal magnetic-field components printed here correspond to those in the (x_c,y_c) plane, i.e., $z_c = 0$.

The next item printed is the (x_C,R) coordinates of the contours, for which LPRCON is the logical control variable. Noting that temperature and velocity contours coincide, the corresponding value of T/TINF is printed along with V/VINF for the velocity contours. There are three nonfatal error messages which may occur - see section A.5.

Trajectory output is the last item to be printed. This output is presented first in terms of the solar-wind coordinate system (x_c, y_c, z_c) , and then in terms of sun-planet coordinates (x_s, y_s, z_s) .

The trajectory coordinates are printed as a function of time and are shown normalized by both RO and the planetary radius. Next, flow and magnetic-field componets are printed for each trajectory point. This output is presented in both nondimensional and dimensionalized forms and includes |v|, v_x , v_y , v_z , density, temperature, |B|, B_x , B_y , and B_z .

The program also has the capability to produce two sets of plotted output using UCC plot routines AXIS, CHAR, DASH, DOTLN, ENPLT, GREEK, MATH, NUMPLT, PLOT, PLTLN, POLAR, SCALF, and VECTOR. The first set of plots is generated when LPLOT = .TRUE. and provides a pictorial representation of the streamlines and contours with a maximum of seven frames produced. The first frame is a plot of the streamlines followed by contour plots of velocity magnitude, temperature, and density. The next three frames are contour plots of the unit parallel, perpendicular, and normal magnetic-field components. These plots are referred to the solar-wind (x,R) coordinate system.

The second set of plots is produced according to the value of the logical variable LPLTRJ. This set consists of twelve plots. The first frame is a projection of the trajectory rotated onto the x-R plane. The second frame is a plot of the trajectory projected onto the $y_c^-z_c$ plane. The remaining frames are time-history plots of density, temperature, velocity, and magnetic field. The velocity plots include magnitude and three components as do the magnetic field plots. The vector components are referred to the sun-planet ecliptic (x_s,y_s,z_s) coordinates.

A.5 PROGRAM ERROR MESSAGES

This section lists the messages printed by the program, and indicates what action should be taken by the user.

(1) ***** EXECUTION TERMINATED *****

RERUN DATA ON TAPE4 DOES NOT AGREE

WITH CASE SPECIFIED ON CARD INPUT:

MACH NO. GAMMA H/RO

FROM CARDS

The first three parameters of item 2 of the input for a case using the rerun option should agree with those used when creating the file. The tolerance used in comparing the values is 10^{-5} . For a user-supplied geometry, it is sufficient for both values of H/R_O to be negative.

(2) ***** EXECUTION TERMINATED *****

ARRAY OF CONTOUR VALUES IMPROPERLY SPECIFIED

When specified, the contour values should be monotonically increasing with at least one value in the range of the velocity, density, or magnetic-field strength for the region under consideration. This error does not inhibit generation of the rerun file.

(3) CONTOUR SEARCH ABORTED - TABLE OVERFLOW IN NAD

The program allows for 29 contour lines to be found, storing the starting address of each contour line in array NAD. This message indicates that at least one more contour line could be found. If the user requires all the contours of the levels specified, the case should be rerun in two parts. Otherwise, reduce the number of contour levels specified.

(4) CONTOUR SEARCH ABORTED - TABLE OVERFLOW IN (X,Y)

The contour lines may be described by up to 1000 points, stored in arrays X and Y. This message indicates that more points would be

required for the contour lines requested. The last contour line found will be incomplete. As with (3), either reduce the number of contour levels or run as two cases.

(5) NEGATIVE PRESSURE DETECTED BY SHOCK AT J=
PN= PO= PTAU=

This message is printed by the blunt-body code when a negative pressure has been calculated at the shock on this iteration, at radial locations J. The quantities printed are: PN, the pressure calculated on this step; PO, the pressure from the previous step; and PTAU, the partial derivative of pressure with respect to time. This condition indicates that the shock wave motion is too extreme. Lowering the value of CN, and thus reducing the time step, may remove the problem.

The following messages (6)-(10) usually result from using an obstacle geometry which is in some way too severe for the program to handle in its present form. The obstacle slope may be sufficiently high at x=0.0 that the axial Mach number becomes subsonic in the starting solution for the marching calculation, or there may be a sharp corner in the profile. Check input, particularly free-stream Mach number and body geometry.

(6) NEGATIVE PRESSURE ON BODY DETECTED BY BNDRY, PB= AT J=

This message indicates that a negative pressure on the body, PB, has been calculated at radial location J.

(7) NEGATIVE PRESSURE OR DENSITY ON BODY DETECTED BY BNDRYM AT X=

PB= RHOB= VXB= VRB=

The program makes internal corrections when this condition occurs, resulting pressure PB, density RHOB, and velocity components VXB and VRB.

- (8) NEGATIVE SIGMA-BAR-1 IN EIGENM INDICATES SUBSONIC FLOW AT I=
- (9) NEGATIVE SIGMA-BAR-2 IN EIGENM INDICATES SUBSONIC FLOW AT I=

These messages are printed when subsonic flow is detected by the marching calculation. The computed stepsize for this region will be quite small.

(10) -----BODY TURN STOPPED AT M2=100-----

This message indicates that the body has a sharp corner, which has been limited to 100° when being transformed.

A.6 SAMPLE CASE

The sample case presented in this section is based on actual interplanetary conditions as measured by the solar-wind plasma analyzer, the fluxgate magnetometer, and retarding potential plasma analyzer on the Pioneer-Venus Orbiter for orbit 3.

The sample case is run alone and is set up to produce all possible output. The gasdynamic solution is to be calculated about a default ionopause shape with $H/R_O=0.03$, $M_\infty=3.0$, and $\gamma=5/3$. The value of H/R_O is based on measurements of ionospheric density and temperature by the retarding potential plasma analyzer. Streamlines, magnetic-field components, and contours are desired to a downstream location of -5.5 x/ R_O . Contour values are specified for all quantities. Interplanetary values for velocity magnitude and direction, density, and temperature were provided by the solar-wind plasma analyzer and for the magnetic field by the fluxgate magnetometer.

The input data is tabulated in figure A.4, with item numbers corresponding to those in sections A.3.2 and A.3.3. The first card, item 0, indicates that there is one case to run. The remaining

fifty-five cards provide the data for this case. Item 1 contains the identifying title. On the next card, item 2, values are specified for AMACH, GAMMA, HRO, and XCALC. The other data fields are left blank to indicate that the default values will be used. values of the logical variables of item 3 specify that the flow field is to be calculated and that full printed and plotted output is to be produced. Item 4 defines the plot length to be -5.5 x/R_{\odot} . The fields for ANGP and ANGN are left blank as they are to be calculated internally by the program. Items 5, 6, and 7 specify the contour levels to be used - 14 for velocity and temperature, 11 for density, and 13 for magnetic-field strength. Item 8 is omitted because the obstacle geometry is one of the default shapes for which the coordinates are calculated internally. The next 37 cards, item 9, are the trajectory coordinates, indicating time (in minutes from periapsis and the three spacial coordinates normalized by planetary radius). Item 10 indicates that trajectory plots are to be generated. This item also specifies free-stream values of velocity, density, temperature, and magnetic-field strength. The next two cards, item 11, indicates that the fourth, ninth, eleventh, and nineteenth trajectory points are to be marked on the plots for cross- reference. The last input card, item 12 indicates that the given trajectory coordinates are expressed in sun-planet coordinates. The azimuthal and polar angles, Ω and $\varphi_{\textbf{p}}\text{,}$ are also specified by this item as are the free-stream magnetic-field components.

Figure A.5 presents portions of the printed output from this sample case. The full printed output is approximately 6,000 lines. Figure A.6 shows the 19 plots which are produced by the program for this case.

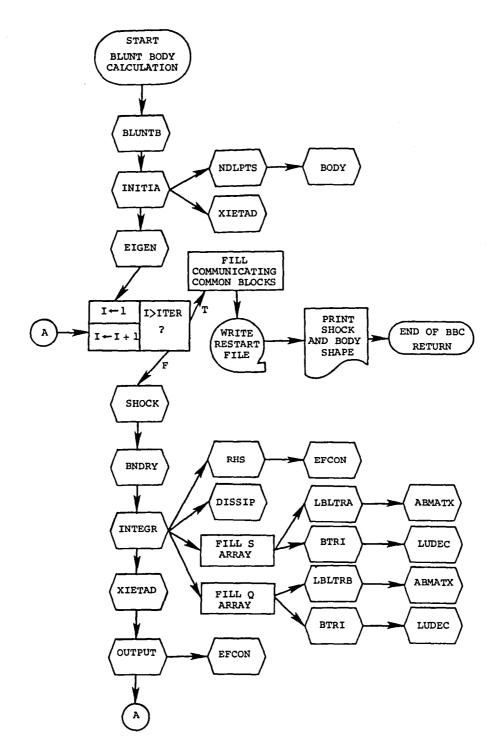


Figure A.1(a).- Flow chart for blunt-body calculation.

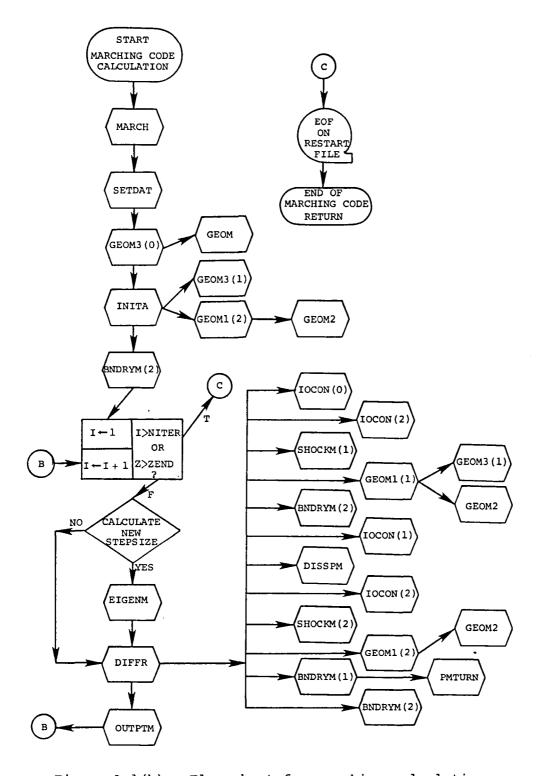


Figure A.1(b).- Flow chart for marching calculation.

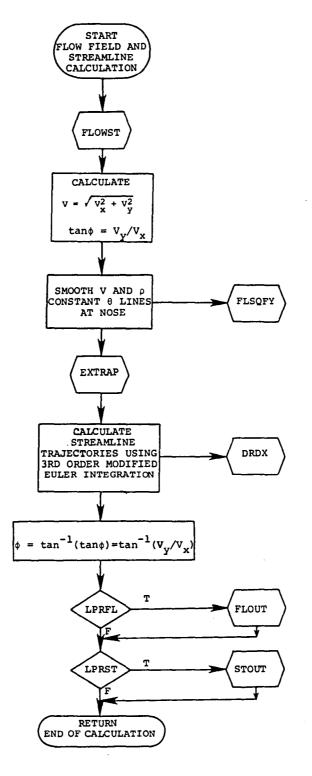


Figure A.1(c).- Flow chart of streamline calculation.

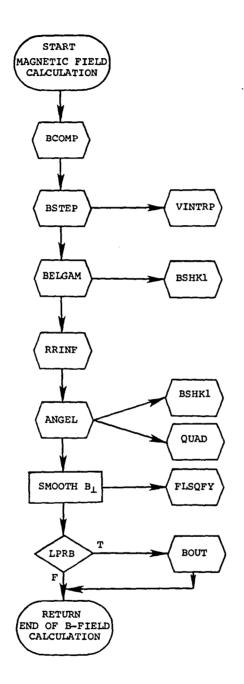


Figure A.1(d).- Flow chart of magnetic-field calculation.

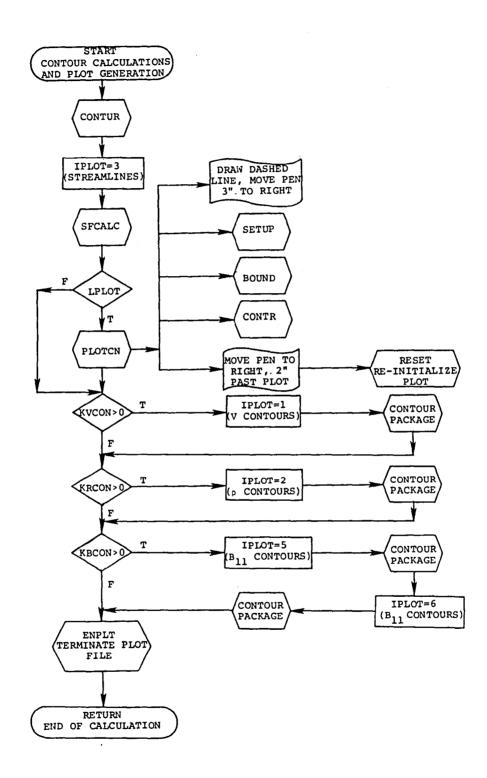


Figure A.1(e).- Flow chart of contour and plot generation calculation.

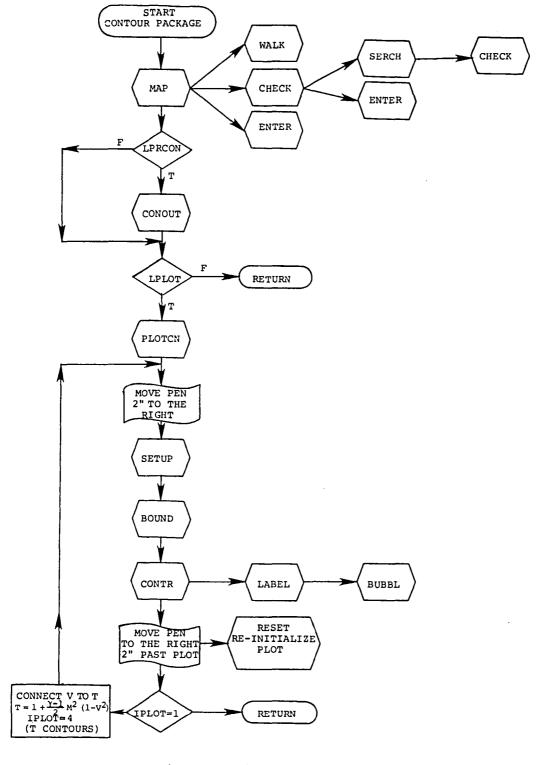


Figure A.1(e).- Concluded

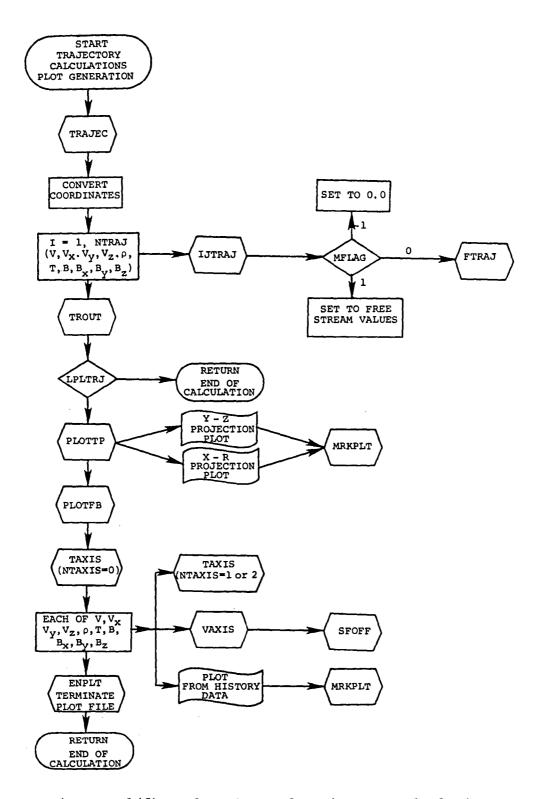


Figure A.1(f).- Flow chart of trajectory calculation.

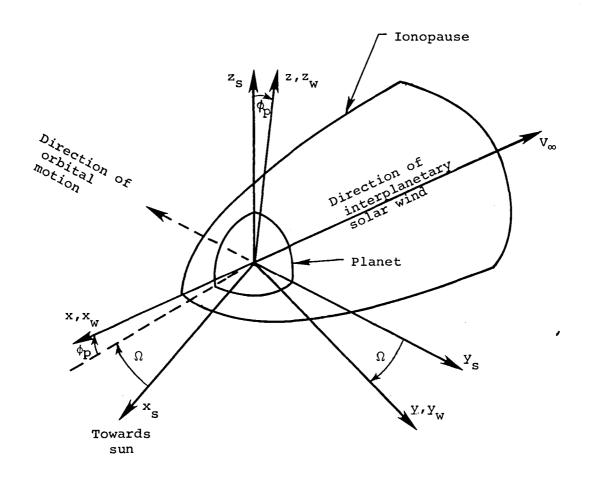


Figure A.2.- Illustration of the azimuthal (Ω) and polar (ϕ_p) solar-wind angles, both shown in a positive sense.

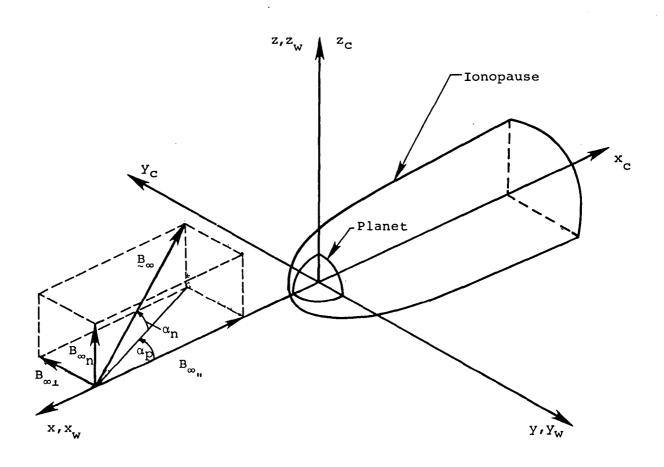


Figure A.3.- Illustration of the interplanetary magnetic field and magnetic-field angles (α_p, α_n) in the solar-wind aligned coordinate systems (x, y, z), (x_w, y_w, z_w) , and (x_c, y_c, z_c) .

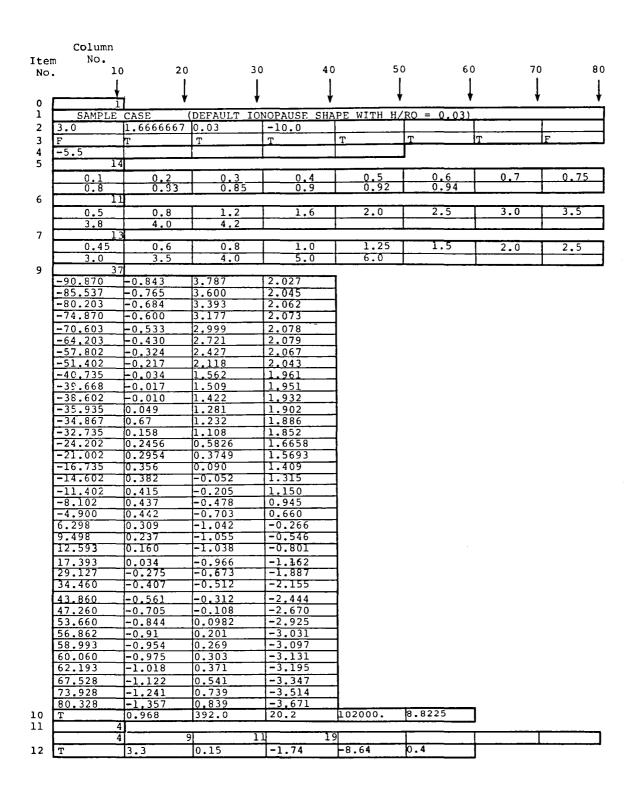
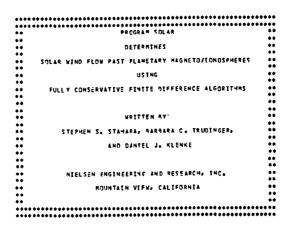


Figure A.4.- Card input for sample case.



LISTING OF INPUT CARDS FOR THIS QUE

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Figure A.5.- Abbreviated print output for sample case.

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Figure A.5.- Continued.

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TTERATTON 5 PMS OF SHOCK SPIECE 1.501212E-12
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Figure A.5.- Continued.

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43				1.1?65
67	43		1441	
4e -11004 1.1441 5.0322 47 -010719 1.1441 5.7551 48 -12305 1.1441 5.7551 48 -12307 1.1441 0.2598 51 -12373 1.1441 5.176 51 -72373 1.1441 5.3762 52 -72373 1.1441 5.3767 53 -13073 1.1441 5.6777 53 -13073 1.1441 5.6777 55 -13176 1.1441 5.777 57 -13176 1.1441 5.7877 58 -13176 1.1441 7.2845 68 -12307 1.1441 7.2845				
47 -6-0719 1-1441 5-72591 48 -7-0309 1-1441 8-099 48 -6-0307 1-1441 8-0329 5: -6-0322 1-1441 0-3299 5: -6-03222 1-1441 5-1776 51 -7-2373 1-1441 5-1777 53 -7-3673 1-1441 5-1777 54 -7-3673 1-1441 5-17737 55 -8-3511 1-1441 6-7337 56 -8-0318 1-1441 7-28-69 68 -6-0571 1-1441 7-28-69		-5.5367		
4a				
40				
5'				
\$1				
\$7				
13 -7,5073 1.44. 5.6262 5.4 -5.1824 1.44. 5.7737 5.7 -8,5511 1.144. 5.9451 5.6 -8,9198 1.44. 7.1154 6.7 -0.2955 1.144. 7.2845 6.4 -0.571 1.144. 7.4526			1.1441	
54				
\$7			1.144;	
##			1.1441	
49 -0.5445 1.1441 7.2845 49 -0.6571 1.1441 7.4526				
-c.6571 1.1441 7.4526				
	**			7,4526
	5 0	258	44:	7.41 GR

PETATLES FLOW FIFLS SUTPU

FL W	FTELD VALUES	EXTRAPOLATER	Lu cammeisa	AVIS, THETA	. 3.6. DEGRESS
1	7 /P.	4/ V I N F	*40/944114*	T/T[NF	PIPINE
1	1.0000	0.0000	3.42.63	4.0363	13.6730
ž	1.8 169	. 3740	3.4344	3, 9983	13.6270
3	1.(228	447	2. 4326	3.9946	13.5900
•	1.6507	. 9551	3.13941	3.4673	13.5331
	100070	.7453	3.3929	3.9767	13.4578
Š	1.1943	.: 53	3.3592	3.9567	13.3549
7	1.1014	. 1756	7.3531	3.9531	13.2554
	1.1.43		3. 3347	3.9375	13.1323
9	10 4452	-1534	5.3.4.	3.0.94	12.9935
10	1. 15 21	.1921	1.2911	1.9065	12.8378
ii	1.1690	121.7 4	3.2562	3. 7745	12.6711
12	1.1857	. 21 84	9, 2393	3.6570	12.4937
13	1.2625	. 2359	3.2144	3. 4232	12.3361
14	1.2197	2428	3.1798	3.0362	12.1294
15	1.2366	.2694	3.1475	3.7723	11.9047
16	1.2135	.2854	3.1135	3.7556	11.6932
17	1.2764	.3209	3.3740	3.7244	11.4760
18	1.2273	37.59	3,6410	3.7008	11.2543
19	1.3642	.3123	3 a will is	3.6667	11.0000

Figure A.5.- Continued.

## GOT # #	COUNTION NO	. (, AT THET		J (UBEFL						
	02/0	9/0.	¥ /R(VR/VINE	AXIALAE	FEDV ANGLE	V/VINE	943/943 THE	TITTHE	P/PINE
i	101111	340	9994		. 300	6F. 1063	0.35	3.4161	1 0664	13.6624
ž	1.17.	355	164	236	233	44.5965	.:347	3.4115	3.9465	13.6340
3	1.1 230	. 7771	1333	. 247		?P.3:13	.3543	1.4344	TAVVI3	13,5877
•	1.6566	.4367	. 5 2	e: 236	. 1593	19.5328	e L 725	1,1740	1,9837	13.5243
5	1.6679 3.6844	. 370	1.0672 1.0841	.6221 .0213	.0900	13.7795 19114	. 029	3.343)	1.9741 3.9625	13.4445 13.3492
7	1.1.17	1364	10101	•12f7	292	9,,979	.1314	3.1525	3.949	13.2390
À	1.3487	3 96	1.1180	.5201	.1400	7.7517	.1487	7.3330	3.9337	13.1147
٥	1 3 . 6		1,2549	96	.1541	6.7313	.1565	3.3132	3.9167	12.9769
16	1.15.25	*C4F2	1.4545	•, : 61	1434	5.9443	•1*43	2,2904	1.6981	12.6264
11 12	1.1695	.7414	10.12"	167 63	• 20 1 1 • 21 • 2	4.3:44 4.7000	•2017 •2169	3.2557	3.6779 3.6562	12.6639 12.4899
13	1.2534	.3426	1.2526		.2340	4.3699	.2356	3.2102	1,6331	12.3052
14	1.2403	.7476	1.2196	-6176	.2515	4.0637	.2525	3.4797	3.6667	12.1143
15	1.2373	.0432	1.2365	.:172	. 254.	3.6647	•269J	3.1473	3.7829	11.9059
16 17	1.254Z 1.2712	.743# .0444	1.2534	*:_k9	.2944	3.3095	.2053	3.1133	3.7557 3.7274	11.6920
1.	1.2112 1.26H.	455	1.2764	165	*3166	3.122; 2.8742	•3615 •3174	3.0401	3.6977	11.4769 11.2414
19	1.31 5.	1455	3 : 43	.61:5 .51	.3337	2.5934	. 3332	3.7011	3.0669	11.0046
AMRULAP	FULTĪTUM HO	, 3, AT THET		0.504.615						
T	99/R.	2/05	Y/P	ABIALME	VX/VINE	FI.TW ANGLE	AIAIAt	847/847[4F	TITINE	P/PINF
1 2	1.64.03	-1"46	. 9748	0474	. 35.47	94.3214	. ,534	3.4725	1.9914	13.5810
2	1.6374	•4963 •1 61	10-119	. C644	.3274 .752.	48.4426 54.5212	.0694	1.3975 3.3903	3.9856 3.9782	13.5411
i	1.6515	.1099	1.5457	. 6644	. 737	43.47##	44734	3.3909	3.9693	13.4200
j	1.6655	-1117	1.6527	.0659	945	34. 1732	.1169	3.3694	1.959	13.3393
4	2.656	.1135	2.9795	.1637	42	20.1349	.1327	3.3557	3.9471	13.2454
7	1.1626	.1753	1.0966	** fla	.1334 .1519	24.3626	•1465 •1643	2.3300	1.9338 3.9196	13.1305
ē	1.1367	•1170 •178*	1.1135	.ue?2	1500	10.0432	-1912	3.3221 3.3022	3.9626	13.6190 12.8871
10	1.1530	.1266	1.4475	£ 573	. 1975	14.9878	.1965	3.2962	7.8846	12.7429
11	1.1796	.1224	1.1644	. 1561	.2044 .2717	15.3034	*2173	2.2563	3.8653	12.5060
12	1.2679	•1242 •125	1814	.:549 . 529	.2317	13.9075 12.7295	.2273 .2435	3.2305 2.2327	3.0443 3.0217	12.4190
14	1.2223	.1277		.1 429	7549	11.7267	.2994	3.1729	3.7975	12.0493
15	1.7391	1295	_ 2323	. 521	.2717	10.7640	.2749	7.1414	3.77.6	11.8479
16	1.2561	•:313		. 5.3	.2877	1 .1209	.2971	1.1779	3.7440	11.6359
17 18	1.2732	•1731	7.062		.3141	44773	.3084	3.4726	3.7146	11.4136
19	1 • 29 02 1 • 3 • 73	1349	1.2432	* 2 · 4 • 2 · 5 · 4	• 32 3 • 37 76	P. 9494 *• 4842	.3249 .3416	3-2356	7.6834 7.6563	11.1813
I VAUNTTÞ	CULTION NU	9,23, AT THET	'A = 86.c120 470.	35GR=65 V9/V[NF	AX\A.Me	FLTW ANALE	A\A(ne	843/843746	T/TINF	P/PINF
i	1.0884	1.3357	. (75)	.; 99)	.5433	12.2794	.4544	.9997	1.7562	1. 7361
ž	1.1424	1.1756	. 757	• 2222	4 A1 F2	14 1913	.3461	1.1977	1.H 423	2.0213
?	1.1964	1.1935	3 3	.2339	.7997	14.2997	. ?341	1.1497	1.9130	2.2941
•	1.2564	1.2473	***** ****	2424	.7#48 .7731	17651	.6223	106777	1.9764	2.5535
6	1.3254	1.3551	242	254	.70-3	17.8554	**067	1.3976	2161 ?513	2 • 79 74 3 • 02 4 7
ž	1.4124	1.4755	765	7562	75 79	14.6133	83.5	2.5570	2.0776	3.2348
8	1.4664	1.4429		. ¿ 6 . t	. 7539	19.1555	.7967	1.5353	2.6966	3.4276
	1.5265	1.5168	• • • • •	.2545	.7667	19.4333	.7942	1.7.97	*•1079	3.6038
1) 11	1.5745	1.570e 1.5245	.1130	.257. .2594	•747e •745 •	19.6521 14.8493	7929	1.7994 1.4477	2.1143 2.1162	3.7642 3.9103
12	1.6425	1.6784	.1174	.714	.74*3	21 01.154	.7927	1.9120	2.1149	4.0436
13	1.7365	1.7323	. 1211	•2731	.7457	26-1348	.7935	1.9734	? 1 . 2	4.1663
14	1.79.5	1.7362	243	.2747	.7440	20.2433	.7945	2.0323	7.1063	4.2806
1. 16	1.6445	1.8401	.1237	•27¢1	•7451 •7454	20.3361	.7956	2.3559	2. 1612	4.3892
17	1.495.26	1.7479	• 4362	.2773 .2763		21 - 4052	.7964 .7969	2,1434	2.0970	4.6307
19	7.6056	2.10117	1405	.2787	•7452 •7466	21.4365	7961	2.2477	2.0955	4.7100
19	2of bi E	2.1556	- 1437	.7910	.7459	20.6477	.7957	2.2978	2.164	4.8263
AVGULAR	LOCATION NO	.24, AT THET	£ = 0,,0338	DEGREE 4						
1	40 /P.	2/93	¥/0,	A5 \A1 he	VY/VINF	FLIM ANGLE	V/VI NF	PHO/PHOTHE	TITTE	P/PINF
1	1.1517	1.1017	-• 30 00	533 .1723	. 1722	16 +61.63 12+1353 6	.8849 .8672	.8977 1.3383	1.0566	1.4818
	1.2514	1.7716	1	2: 97	.8247	14.2631	. 9524	1.1127	1.0205	2.0257
3	400012		1.00	• 22: •	9.99	15.31.7	. 940.	1.2123	1.8828	2.2826
ă.	1.2616	1.1.15			.7953	16.1522	.8362	1.3769	1.9325	
5	1.2616	1.3415	0100	.2135	144 -					2.5257
ă.	1.2616 1.3415 1.4.15	1.3415	0100	.2135 .2379	•7957	16.8154	. 5224	1.3968	1.9711	2.7533
4 5 5 7	1.2816 1.3415 1.4.15 1.4614 1.5214	1.3415 2.4 15 3.4614 2.5714	0300 	.2435 .2495	•7957 •7795 •7742	16.8154 17.3513 17.7921	.5224 .5122	1.4922	1.9711 2.3651	2.7533 2.9647
4 5 7 8	1.2616 i.34:5 1.4.15 1.46:4 1.5214 1.5613	1.3415 2.4 15 3.4014 2.5714 2.8513	0200 	.2435 .2495 .2526	•7867 •7796 •7742 •7773	17.3513 17.7921 19.1583	.5122 .5094	1.4922 1.5534 1.6407	1.9711 2.3661 2.0268 2.0345	2.7533 2.9647 3.1595 3.3360
4 5 7 8 9	1.2616 i.34i5 1.4i15 1.46i4 1.5214 1.5813 1.6413	1.3415 2.4 15 3.4614 2.5714 2.4613		.2435 .2495 .2526 .2563	•7867 •7795 •7742 •7773 •7574	17.3513 17.7921 19.1383 10.4659	.5122 .5122 .9094 .5)78	1.4922 1.5534 1.6407 1.7142	1.9711 2.3621 2.0268 2.0345 2.0423	2.7533 2.9647 3.1595 3.3380 3.5011
4 5 7 0 0	1.2616 1.34:5 1.4.15 1.46:4 1.52:4 1.56:3 1.64:3	1.3415 1.4 15 1.4614 1.5714 1.8713 1.6413		.2436 .2455 .2526 .2563 .2595	•7557 •7795 •7742 •7773 •7574 •7554	17.3513 17.7921 19.1583 18.4659 19.7265	.5122 .5122 .9094 .9278 .8271	1.4922 1.5534 1.6407 1.7142 1.7443	1.9711 2.36ú1 2.0268 2.0345 2.0423 2.6455	2.7533 2.9647 3.1595 3.3380 3.5011 3.6499
4 5 7 8 9	1.2616 i.34:5 1.44:5 1.46:4 1.52:4 1.56:3 1.64:3 1.7:12	1.3415 2.4 15 3.4614 2.5714 2.4613	0000 	.2435 .2455 .2525 .259° .259° .259°	•7867 •7795 •7742 •7773 •7574	17.3513 17.7921 18.1563 18.4654 18.7265	.5122 .5122 .9094 .5)78	1.4922 1.5534 1.6407 1.7142 1.7443 1.0512	1.9711 2.3661 2.0268 2.0345 2.0423 2.6455 2.6455	2.7533 2.9647 3.1595 3.3380 3.5499 3.7861
4 5 7 0 10 11 12 13	1.2616 1.3415 1.4415 1.4614 1.5214 1.5213 1.6413 1.7.12 1.7612 1.8241 1.8241	1.9415 2.4 15 3.4624 2.5724 2.4623 2.6413 1.7712 2.17612 1.4711	0200 1/ 	.2435 .2455 .2526 .2563 .2596 .2523 .2649	•7857 •7795 •7742 •7774 •7574 •7554 •7682 •7695	17.3513 17.7021 19.1583 10.4659 19.7265 18.9491 19.1395	.8165 .5122 .9094 .3278 .8272 .8272 .9278	1.4922 1.5534 1.6407 1.7142 1.7443 1.6512 1.9151	1.9711 2.3621 2.0218 2.0345 2.0423 2.6455 2.8452 2.8452 2.8452	2.7533 2.9647 3.1595 3.3380 3.5011 3.6499 3.7861 3.9117
4 5 7 8 9 10 11 12 13 14	1.2616 1.3415 1.4614 1.5214 1.5214 1.5214 1.5214 1.5214 1.7612 1.7612 1.7612 1.8241 1.9811	1.3415 1.4 15 1.4614 1.5214 1.6413 1.6413 1.7712 1.67612 1.6711 1.6411		.2435 .2435 .2526 .2526 .2547 .2523 .26471 .2591	.7867 .7795 .7742 .7774 .7574 .7554 .7641 .7632 .7625 .7625	17.3513 17.7021 14.1583 10.4654 14.7265 18.9491 19.1395 19.3041	.8165 .5122 .9094 .9371 .8371 .8372 .9379	1.6922 1.5534 1.6407 1.7142 1.7443 1.8512 1.9151 1.9763 2.0351	1.9711 2.JC&1 2.0268 2.0345 2.0423 2.6455 2.6455 2.6420 2.0347	2.7533 2.9647 3.1390 3.3380 3.3011 3.6499 3.7861 3.9117 4.0290
4 5 7 0 10 11 12 13 14 15	1.2616 1.3415 1.4614 1.5214 1.5213 1.6413 1.7.12 1.7.12 1.7612 1.8611 1.8611	1.3415 1.4 15 1.4614 1.5214 1.6413 1.6413 1.7712 1.7712 1.7712 1.7712 1.9411 1.9411		.2435 .2435 .2526 .2526 .2547 .2523 .26471 .2591	-7867 -7767 -7742 -77-3 -7574 -7574 -7692 -7692 -7693 -7618	17.3513 17.7021 19.1563 10.9659 19.7265 19.9491 19.1395 19.3041 19.4461 19.4464	.5125 .5122 .5078 .8371 .8372 .9376 .8096	1.4922 1.5324 1.6407 1.7142 1.7143 1.8512 1.9151 1.9763 2.0351	1.9711 2.0218 2.0218 2.0345 2.0455 2.0455 2.0455 2.0452 2.0420 2.0347 2.6317	2.7533 2.9647 3.1395 3.3380 3.5021 3.6499 3.7861 3.9117 4.0293 4.1406 4.2495
4 5 7 8 9 10 11 12 13 14	1. ZE16 1.3415 1.4614 1.5214 1.5214 1.5213 1.7.12 1.7612 1.8241 1.8621 1.9411 2.0010 2.0010	1.9415 1.4 17 1.4614 1.57214 1.67218 1.67218 1.67218 1.67218 1.67411 1.69411 2.67216		.2435 .2495 .2526 .2523 .2549 .2549 .2671 .2591 .27-7	.7867 .7795 .7742 .77.3 .7574 .7554 .7651 .7632 .7625 .7621 .7619	17.3513 17.7921 14.1563 16.4654 17.7265 17.7341 17.1395 19.3041 17.4461 17.5544	.5125 .5122 .5078 .5271 .8272 .5275 .5266 .8496 .8162	1.4922 1.5534 1.6407 1.7142 1.7443 1.8512 1.9151 2.0351 2.0351 2.0351 2.1462	1.9711 2.0218 2.0218 2.0345 2.0425 2.0455 2.0452 2.0420 2.0387 2.0347 2.0347 2.0309	2.7533 2.9647 3.1395 3.3380 3.3011 3.6499 3.7861 3.9117 4.0295 4.1406 4.2495 4.3387
4 5 7 8 9 10 11 12 13 14 15 15	1.2616 1.3415 1.4614 1.5214 1.5213 1.6413 1.7.12 1.7.12 1.7612 1.8611 1.8611	1.3415 1.4 15 1.4614 1.5214 1.6413 1.6413 1.7712 1.7712 1.7712 1.7712 1.9411 1.9411	-0000 -0000 -0000 -0000 -0000 -0000 -0000 -0000 -0000 -0000	.2435 .2435 .2526 .2526 .2547 .2523 .26471 .2591	-7867 -7767 -7742 -77-3 -7574 -7574 -7692 -7692 -7693 -7618	17.3513 17.7021 19.1563 10.9659 19.7265 19.9491 19.1395 19.3041 19.4461 19.4464	.5125 .5122 .5078 .8371 .8372 .9376 .8096	1.4922 1.5324 1.6407 1.7142 1.7143 1.8512 1.9151 1.9763 2.0351	1.9711 2.0218 2.0218 2.0345 2.0455 2.0455 2.0455 2.0452 2.0420 2.0347 2.6317	2.7533 2.9647 3.1395 3.3380 3.5021 3.6499 3.7861 3.9117 4.0293 4.1406 4.2495

Figure A.5.- Continued.

	eful etrito Avince code avadeure Coffentation												
4007777	MAL ARIAL L	TOATETH HO. :	, AT Y/P.	,.465									
,	2/8.	V1/Y14F	MALALME	FERN ANGER	4/41×F	2 47 /2 HET NF	7/T14F	P/P THE					
1	1.10 of	.1421	. 349:	9. 1.:	.9. 4		1.5674	1.315					
?	1.17.5	1752	. 2149	11.1141	.1776	. 3522 1672	7.7722	1.4787					
3	1.297	. 77 6 6		14.7234	. 14 . 0	1.17.4	1.9384	2.1513					
•	1.3547	,, 0,		110170	49.4	1.2651	1.49:2	2.3925					
5 7	1.41:5	.7342	.7987 .729	15.9462	4251	1.4395	1.7574	7.9177					
é	1.5419	. > 4 * 7	.7-47	.7. 799	. 8?	1.5213	1.9775	200343					
	1.663?	-542	• 74+ 3 • 775=	17.1.96	.314? .9163	1.5062	1.9976 2.2012	3.1971 3.3549					
;5 11	1.7271	2144	7743	662	413.	1.7499	2.0077	3.3124					
17	1.7444	. 74.78	. 7724	19.4542	. 5.43	1.6205	2.0116	3.4505					
17	1 • 65	2518	• 77;	16.6453	. 9] 30	1.5783	2175	3.0001 3.7319					
14	1.5123	2424	•77£€ •75 €	16.4467 19.6621	. 1134 . 6137	2.0145	7.5139	4.6569					
26	Pat 355	. > 5 7 7	. 7.4.2	_9.2111 19.3222	. 51.25	2.6729	2.0144	4.1755					
17	20647:	. 26°2 . 27 . 6	. 7578 . 7544	19.3227 .9.4171	•5137 •1144	2.1269	2.0102	4.2132					
18	7.1592 2.2210	>7>2	.7544	3 40	31,32	7.2297	2.4 61	4.4734					
470[7[0	MAL ATTAL LA	י אר ערידאיי	* AT Y/P_	0935									
·T	7/45	VC/UTVE	VY/V[KE	ELON INCLE	4/414F	947/94774F	T/TENG	P/PTME					
	104.87	41271	. 45.33	FIOW ANGLE 7.7014	. 7115	.7913	3 .5 /76	1.1925					
?	1.16.2	.1572	723	11.01908	. 1870 .8714	1.0224	1.6347 1.7219	1.4791 1.7605					
3.	1 • 2 4 3 1	.047	.5527	12.1470	. 45 40	1.1263	1.7215	2.3179					
i	1.37.7		21_	. 4 47.	. 4471	1 4 2 7 2 1	1.5471	2.2572					
2	1.4244	. 21 47 . 227	• 6100	15.1179 15.5141 16.3955	. 4347	1,3,32 1,4074	1.8443	2.4798 2.5967					
'	1.561*	. ****	7344	16.39::	.3331 .584	. 4642	9467	2.4804					
9	ineti.	, 1197	.7907	16.49.9	4 175 3	1.5657	1.9567	7.0626					
17	1.06 26	7449	.7tst	17.2149	423.	1.6434	1.9579	7.2741 3.3957					
11	1.75?1	2532	.7627 .7464	17.6651 17.6763	• \$2.5 • \$2.5	7915	1.9965	3.5481					
12	1.1742	.2"47	.77ne	15.2452	. 5199	1.5011	1.9436	3.6921					
14	1.9427	2197	.7771 .7753	1.470	. 11 93 . 11 # Q	1.4275	1.986) 1.986)	3. #280 1. 9575					
15 16	?+\+63 ?+6e98	2646	7746	4944597	-4:50	2.5	1.9699	4- 400					
17	201324	.7456	. 7790	192	. 31 * 5	7. 4 65		4,1928					
19	7.26	• ?5#3 • ?497	.7737 .7743	19.1214	•1.91 •1¢?	2.1599	9873	4.2923 4.3496					
•		JETTIJA AU*			• •		•						
1	•/•	VEZVINE	VALALINE	ELUR WALL	V/V[NF	add tedulide	7/][WE	PIPTHE					
i	1.1441	•	. 44.2	••••	. 14: 2	. 5:45	1.3423	. 3910					
;	1.4940	- 12	. 4545 . 407.	-0.747	. 7545 . 7576	.7:44 .7455	1.26e5 1.1945	.9921 .9919					
	1.6491	- 12 - 23	1775	133*	3776	7.76	7.2327	. 4923					
	2.544.	42 5 43 74	496	2440	• 7761	. 1227	1.0925	. 1907					
ç	2.6955 3.2471	-	9962	: * 77 7498	, 1923 , 776?	. 450 9	1.0229	.4961					
4	3. 5974	- 7		41 65	. 3300	4111	1.004	. 4962					
0	1,0470		37	7.26	. 1 14	.,-29	. 9764	. 2639					
112	4.244	7.710	1. 42	-11334	1	. 4954	. 9745 . 991 3	.8726 .9222					
12	4, 4443	124	. 2272	. 74 -	. 2271	. 4792	1 - 162	. 9951					
: 3	1.3.94	. 2*	. 61, 1	1.5197	9921	1318	1.0467	1.0793					
14 15	5.7(13 4.6567	0541	. 4951 . 9641	3.1578	.7957	1. 407	1.0779	1.1712					
14	5.41.2	A . 2.7.	. 3735	3,6347	.9759	1980	1.1427	1.3693					
17	5.7=17	- 1.74 %	. 94.75	44.6275	. 97.16	1.2-14	1.1737	1.4687					
14	7.11 EE 7.4:26	. 003	. 4459 . 9349	5.3724 5.9165	. 9544	1.3095	1.2377	1.6771					
4071710	MAL ARTAL EF	DCATI74 NO.45	at X/Ru	-17-0254									
;	*/*: 1.1441	ABVALME	este.	ELUM THEFE	,4/4£4£	*47/#47[NF 60157	T/T[NF 1.3439	P/PINF . 1946					
:	1.5.29	-40013	. 9: 47	7!* :3e3	9547	.7.65	2.2659	.8947					
3	1.8637	(623	. 70 74	:363	. 7674	.7561	1.1922	. #943					
•	1.2234 2.5452	11	.97#1 .9967	1707 2432	.7741	.7920 .3276	1.1297	. 9948					
ž	2.9429	- : :2	. 9724	2974	. 9926	. 8554	1.0433	. 3919					
7	2.3,27	;?	. 9965	2572 3545	. 1950	11.0	£ 35 v s l	.8979					
	3.6674 4.6227	67 126	1.0036	3545 6440	20.36	49572	.9752	. 1678					
2.	4.3t2.	-, -11?	1.0045	6*75	146	. 6965	. 9725	.8719					
11	4.74:7	2:	22	1136	25 M	9795	-9973	.9174					
. 2	7.1013 7.4612		. 97. 7	.6416 4.4491	.9990	.9761 1.0270	1.0122	.9880 1.0703					
14	4.621	.r36a	. 497 .	1.262.5	. 7977	7.1915	4	1 1484					
15	5.1777	43520	.911;	3.63:3	.9524	1355	1.1,47	1.2543					
14 27	5.54.5 5.5u03	762	.9746	3. FCFA 4. 4965	9768	1.1913	1.1376	1.3552					
1€	7.26 .	*42	.9617	5.2421	. 7557	1.3015	1.2022	1.5648					
- 0	7. 6. 9F	. 371	. 456.	10% %	. 7611	1.3494	1.2295	1.6590					

Figure A. 5.- Continued.

42 STREAMLINES CALCULATED

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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             .719
.471
.52.7
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Figure A.5.- Continued.

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STREAM THE NO.47. STARTING AT MICH # -- ... 5-3.29
        emprenting of.ed. Stanting at viol = -5.4133, 0/0, = 5.4362
          */P9 0:77
-1:4133 5:4341
-1:4676 5:4461
-1:514: 1:4579
-1:5367 1:4579
```

Figure A.5.- Continued.

MAGNETIC ELEFO COMBONENTS

Tachif to	LOCATION N	O. 1. ST THEF	* * 5.0500	naceair					
t	00/5	3/8THF [PARKLLEL]	4/4(HF	M/MINE (IM-DLANE)	9-ANGLE (TH-PLANT)	4/9[4F (HTRM4E)	RY/RIME (RESULTANT)	AVIAINE (PESULTANT)	97/SINF (PESULTANT)
1	1.0541								
,	1.0169	. 1419	120.442	:1.6849	89.9445	3.41 F4	.: 115	11.9724	+1558
3	20.334	.1524	S. 7572	6.6763	19.15.6	3-4126	213	9.6e13	.1555
4	1.05:7	• 27 17	7.19.5	7.1192	39.7535	3.3941	• (32.2	7.1116	.1551
•	1676	.2567	6.2600	6.2174	19.5251	3.3429	.0465	6.2112	.1546
é	4 .	. 3" 4 *	5.0047	5.6 49	60.40.4	3.3592	. 3499	5.632	.1540
7	1.1614	4101	*.1904	: 3 9 2	10.3433	3.3:31	. 589	5.1335	. 1533
•	7.1143	4414	4. 1735	4.5217	99946	3.3347	. 4575	4.9202	. 1524
9	1.1352	•5416	4.:573	4-:177	39, 1335	3.3141	. 1763	4.5174	. 1515
13	1.1521	.5004	4.3350	4.2926	15 - 17 > 5	1.5311	. 1942	4.2975	.154
11	1.169. 1.1650	+6547 +7:73	494	4.0700 3.8017	42.7377	3.2662 2.2393	.2919	4.0746 3.8964	493 .1481
13	1.2.25	7 71	2, 9295 3, 7133	3.7476	56.3729			3.7424	
	1.2107		3.6351	3.67.8	14.1116	3.21.4	.1563	3.5953	•1467 •1453
15	1.23:6	2479	1,4934	3.4616	94267	3.475	.1197	2.4551	.1439
16	1.2310	APRE	3, 3432	3.3526	87.3551	7.1135	1244	7.3469	1423
17	1.27 4	176	3.27t.	3.2462	97.7320	1.0750	. 1363	3.2492	11467
i i	1.2673	961.2	3.1451	3.1796	97.5360	3.6410	.1344	3.1334	.139
19	1.3642	1.0:0:	3	2.9735	47.2900	3.0000	1404	2.9671	1371
		O. 2, AT THEY							
T	3 P /R	4/41NF	PATHE	R/ATHE	4-A4GLE	9/9146	PY/974E	47/8145	**/8INF
	1.0065	(PAPALLEL)	(6.25 b.)	(IN-PLANE)	({ M-PL & M= }	(NUSER)	(RESULTANT)	[#FFI][TANT]	Chezoftants
1	1.17	.3466	11 444	** ***			****	11.7418	****
ŝ	1314	•1161 •1878	11.7564	31.75C4 9.627L	96.1712 96.1159	5.19)5	.3412	*.6133	.2372 .2288
3	1 5119	2400	7.1665	7.1018	34.1429	5. Ju 5.) 4. 7499	.2200	7.3907	.2189
	1. 675	31.42	2.219	6.2.47	A# 134*	4.0098	2619	6.1989	.2167
6	1.0846	376e	5.0.5.	5.65	44, 1666	4.46JP	1845	5.5925	.2039
ž	7.1617	.4371	5740	5.1341	47.974	4.3127	1811	5.1256	.1971
á	1.1167	42" 6	4 36	4.4.71	7. 1727	4.1792	.1755	4.4067	1910
ė,	1.2356	4571	4. 14.12	4.1166	17.75.7	456"	-75	4.4985	.1854
14	1.4225	4A 65	4.1166	4.2854	17.5474	3. 7327	1757	4.2773	.1797
11	1695	.45**	4 3 .	4. 735	*7.53.2	9. 6141	.1753	4.0658	. 1745
12	1.1864	* * · Gr	3. 4133	3. 86 65	47. 4"6?	1.7:74	757	3.6765	.1495
13	1.2.34	.7:71	1.7257	3.74.2	*7.293	1.5965	.1772	7.7331	.1044
14	1.2263	. 31130	3.619	3.2068	17.1554	2.4924	762	3.5966	.1596
15	1.2372	. 564.8	3.4777	3.4549	37.3524	3.5337	.1775	3.4464	.1549
:6	1.2542	3	2.3605	3.2445	47.1041	3.2973	.1677	2.3370	.1502
17	1.2712	C>78	3.2964	3.297	17.1714	3.1916	.1595	3.2296	.1458
1*	1.265.	. 945	3.15 3	3.1754	37.7493	3.6952	.15.1	3.1?25	-1415
19	*#t5	• • • •	3. 14	2.0474	35.4373	3.07.11	.1951	2.9735	•1372
44011 40	LUCATION N	n. 3, 47 THET	A . Same	7:59926					
*	** /*	4/41HE	4/4[45	*/=THE	-ANGL	9/978F	4 y / 3 N F	44/41MF	A7/BINE
		{ P # P # 1 L F L 1	(P:0P)	(I N-PE APE)	([N-PLAN:)	f FTRMAL F	TRESULTANTS	(RESULTANT)	(RESULTANT)
1	13	.1317							
ş	1.6174	.2356	1: . 55 76	11.474C	44.4970	4.9765	1.1.11	11.4099	-4685
3	1.0344	2400	3, (5) 0	• 12	14.6409	4.3471	.7919	*• 4553	+3015
•	1065.3	. , , , ,	7. 5.2	7./ 230	34.7598	A . 995 9	.6i61	6.9995	+3147
	1 41 6 55	. 3 741	* * * 3	6.452:	45.1166	501.42	.5243	6.1333	.2744
5	16:6	4454	* . 5 3 3 2	2.16.25	97.1340	5.4257	4773	5.5367	. 2484
7	26	*6063	5 94	5.76.26	15.1275	4.9977	. 4332	5.0791	. 2284
:	1.1197	.5459	4.74:7	4.7 .=	?:. 926	4.0435	•4JF6	4.7594	.2141
	1.1367	.5949	4.4995	4.4712	85.3739	4.4229	.3541	4.4577	. 2022
1"	1-1536	.5429	4.2557	4.2764		4. 1955	.36*7	4.2259	.1918
- 11	1.17.4	.4369	4563	4.3457	14.9972	4.0059	.3524	4.3293	.1831
1.2	1.470	.7350	9, 971, 5	3.2544	94. 3394	3.8349	.3465	3,9453	. 1755
13	1.26.	. 797 7	3.72.7	3.7,79	34.1762	3.0545	.3317	3.6992	.1684
14	1.7275	. 8244	7.5774	3.1729	54.8153	3.5496	.1225	7.5555	.1622
	1.2391	• *66R • 3: 70	3.4393	3.43*9	94.7555	2.4241	.3131	3.4180	. 1565
15			3.326%	3.3247	54.7153	3 . 30 5 5	.364	3,9971	. 1511
14	1.2:62	9477	2 216	2 2 7/	84 4950				1144
14 17	1.2732	.9477	3.7140	3.2.76	44.6759	3.1084	.37()	1962.6	-1462
14		.9477 .3861 1+0231	3.7150 3(; 2.4891	3.2176 3.1113 2.9311	#4.6??9 #4.5340 94.4344	3.1984 3.3957 2.3968	•37() •2961 •2913	3.2)01 3.0944 2.9738	•1462 •1415 •1376

Figure A.5.- Continued.

TACIN TO	LOCATION	en.cs, et THOTE	. 14*	1.69-65					
1	PD / 6.	8/814E	*/****	# } #] N= # [AN- }	1-140[5	9/414F /9724413	**/*[4º (***)*[144])	RYPRINE (PTFIILTANT)	BT FRINE
	1.0544	(PARALLE) 9559	(btob)	(14-2(14.)	(14-5/14-1				
1	10,929	- 934.0	3.5484	3.7+22	21 444	4. 37: 9	3,4003	1.3424	.1563
7	1.1444	1,1659	7.0143	2.717.	274.395	2473 2.7322	2.434. 1.0587	1.2455	-1411
4	1.25:4	1.1659	2.1347	2.321:	35.4474	2.7372	1.5*1.5	1.2557	249
•	3. 44	14.284	1.0745 E 44	2.1(:1	41-1927	2.4599	1.49*7	1.3.75	.1126
7	1.4.24	7.2464	7-53	2.60	44.3750	2.4.25	2.3724	1.3442	.1.98
è	. 4054	. 1: 5 +	.74.5	: 3 5	• P• 34÷	2.3434	1.7745	: - 1340	.10 ec
9	1.525:	2.3474	1.7127		49.3.24	. 3364	1.1706	1.4197	.168
11	1.5745	3.16.3	:.0773	1.44:1	51.4353	2.3/67	1,1343	1.4797	.1654
12	1.6204	1.2157	1.566.	13?i	55.3172	2.3.	10 741 3	1.5154	
11	107255	1.555	57?7	1.5374	56.7323	7.2935	1.0041	1.5305	. 1 . 48
24	1.79 :	5' 47	447/7/	4.1257	37.745	2.2017	.9721	1.4*49	.1.47
15	2.8445	3.5619		1.543	59.1324	2.2691	•9453 •9277	1.5056	.1046 .1u46
15	. 6985	1.7171 1.7563	1.00	444	56 + 9435	1.70.0	2 44	2786	1647
17 15	1.952t 2.666	1.7978	7137	1.4762	51.1431	2.2927		246 2.4502 1.6572	.1.48
1é	?olt t	7. 42.45	7. 5	2.4777	52. 3624	2.2978	2783	1.6572	.1.16
		CO.24. AT THETA	- 9 (155)	1460115					
\$41E ##	Co. Millor								
•	PP / P	9/9745	9/91NE	HINTHE	R-ANGL 4	4/41HF	MALGINE	441414E	PT/SINF
		(PAPAILEL1	(> 00)	CIN-OFFALS	(14-5f 14÷)	INCAPT?	[* [* []] *] *]	(DE SULT MAL)	(4EZIIL TANT)
1	101117	. 7144			6	9. 9114	1.94.	1., 315	. 1 % 1
3	1.1616	.4741 .7474	1.305 P 2.41 44	3.4:45	2: -1346	7.7719	3.261	1.4319	.17.i
	1.5814	1		2.195f	31.2556	2.3491	1+1270	1.1229	. 1165
Ť	34.5	1449	2. 2.46		35.51.6	2.4.153	1.4661	1.1565	.1699
6	1.04(1.1447	. 72: *		+1.7+71	2.3271	1.4337	1.2794 1.2614	.1664
?	1.4614	1.2107	1.6343	7768	47.2529	7.2795 2.2349	1.2424	1.2014	.1631
•	1.5714	4.376	1.5152	1.7548	44,4915	2.2279	1.1284	1.3416	. 1623
10	1.0423		4 . 5 . 3 .	1.75 AR	>2. ** e3	2.22.09	201722	1.3751	. 5.19
11	1.7.12		1. 596 6	1.7415	53.435?	7.2252	1.7256	1.4757	-1017
i 2	1.76.2	.4743 .5449	1.5967	407424	55.423 56.3345	2.2717 2.2245	9977	1.4533	.1016
13 14	1.8211	1.0996	1.5.15	74ec	53.2398	2.2263	. +223	1.4498	.1614
17	1.6411	472	1.51.4	1.765	49.3552	2.2705	. 6961	1. 9174	.1019
15	2.0610	:. (347	1.52?1	1.7700	04.2969	7.2337	. * 1 . 5	1 - 2 - 3 5	•1•57
17		73.00	1.53.0	1.7935	51.3653	7.2346	. 4574 . 4594	1.5577	.1c23
14	2.1269 2.1519	10.74	1.548.	1.4197	51.3156	2+2+32 2+3575	9527	1.5705 1.6558	11.54
14	- 4 4 5 14	40	****				*****		
******	NAL AXIAL 1	OCATESM HOS SO PRETME COAPALLALS	AT Y/F, .	5464		9/9[NF	MY/41HE	AVFRINE	97/5[NF
*	7/9,	(r4741L211	125361	A/ATNF	#-#456 3 (! N-DL 4 N= }	1473E4F)	(RESULTANT)	(PETIL TANT)	(PESULTANT)
1	1.1: 98	1669							
ž	1.1715	. +147	1	2027 5	.h. 167	3.551.7	3-16-2	1.1103	.1623
3	1.7333	0.01	7.3.49	2,4133	74,4755	2.7529	2.1471 1.7644	1.6142	.1250 .1131
•	1.195 1.35 o 7	3334 1.7616	1.7581	2.1.48	30.94.3 36.459	2.4755	1.5153	1.1972	. AL-70
4	1.41.4		1.6595	1.75+7	40.3115	7.2672	1.35 PA	1.1557	.1436
7	1 4 4 t 1 Z		. c. tv	4.7369	44.24.2	2.2735	1.7430		.1016
•	1.5419	1.7461	1.1777	1.7	474.563 49.7439	2.2.2.	1.1626	1.2535	.1666 .1061
17	1. 6. 27	1.3464	1.5534	2464.1	5915	2.1543	2-435	1.3349	.0999
ii	1.5654	1,6762	3.47	1.697"	57.4591	2.1*76	. 9964	1.3349	· Luce
15	. 76 **		1.5:47	1.7676	55 + 50e 5	7.1907	. 9634	1.4021	• • • • •
2.3	1.6566	. 437		1.7275	56.7433 58.2436	2972	.9317 .9649	1.4341	.1667
14 15	1.9123	1.679;	1.5724	4.7375	59.4370	2.2095	. 4425	1.4945	1616
16	2.6357	1. 4467	1.5562	4.753	53645	202.43	.4657	1.4945	.1012
17	7. 97:	1.710	1.6110	1.76*3	61.6556	2.2199	.8449	3.5458	. 1615
11	2.1592	1.7713	1.0136	1.796	61.1140	?.2231 ?.2297	. 9409	1.5962	.1u16 .1u19
19	2.22	20 9 277	1.0332	7. 146,	62.0527	:02241	. 7407	163774	****
APPTTTP	MAT AVIAL I	OCATION MO. ?.	AT Y/95 .	691:					
•	4/2.		4/4[Me	4/P] N= 1	9-ANGLE	R/RINF	PY/RTHF [PESIIL TANT]	97/574F	97/8INF
1	3+4447	(P 49 ALLEL)	(-500)	(Mari val)	(. M- P(a M))	falleder t	1-61/61=111	11611612111	***************************************
į	1.11.2	. 9 134	3334	3.11.55	40.5126	3.41.65	5.ente	. 6946	.1557
•	1.243+	- 4969	2.2135	2.334.	23-3501	2.6573	2.1349	•931c	.1215
•	1 - 21 72	2564	1. 95 97	1.6767	36,2432	2.3979 2.2737	1.7067 1.4557	1.0468	.1496
•	1.37.9	1.1373	1.5952	1.P(3u 1.7194	35.5363 40.1333	5.5(95	1.3132	1.1371	.1616
i	1.4070	: 4465		4.t7/3	43.9325	2.1727	1.2074	1.1531	. G 993
	1.5e1:	:.2297	1.:277	1.45.7	47. 3377	2.1551	1.1293	1.2126	. 0965
•	1.62:2	147417	10:150	1.1524	44.6167	2.1492 2.1489	1.5693 1.6185	1.2977 1.2988	.0982
12 11	1.7571	1.4126	1.5165	1.6523	53.9526	2.1542	.9764	1.3366	985
::	1.6117		1.5122	1.6556	5:.5619	2.1597	-9469	1.3722	.0587
13	1.6792		53.5	1at 77t	56.9954	2 • 1 • 9 5	.4124	1.4054	. 6992
14	1.9427	145*93	1. 5454	1.5005	50.3149	2.1761 2.1660	.8672 .9659	1.4374 1.4698	. C 995
::	7. (.63	1.63/3	1.5725	1.7256	59.5.00 5.41F9	5. 1490	•9677 •*517	1,4991	.1442
16 17	7.0693 2.4334	1.7244	1.5075	1.7432	51.3454	2.2064	.8421	1.5243	. 2066
2.8	5.7684	1.75 92	29	1.7521	61.3974	2.2054	.5427	1.5454	. 1668
19	2.2675	1.5137	1.0142	1.777*	52.1791	2.2121	. 1365	1.567?	. 1.11
ADDITIO	MAL ANTAL I	CONTINE MO.44.	AT 1/45 -	-1.2651					
1	9 /8 1	4/4746	R/91NE	A/ATHE	9-ANGLE	RIBTHE	BANBENE	SYLVINE	57/8[NF
		(PARALLEL)	(PERP)	(IN-M PHE)	(IN-offde)	(NOTHEL)	(RESULTANT)	14420f19M13	(TRAT JUCS
1	1.3767	.6148 .5440	1.1571	1.26.7	19.5739	1.5481	1.1931	.4032	. 6768
3	1.6132	-4748	9549	1.0377	54.1952	1.2495	.5894	.8160	.6571
4	1.6474	.7177	. G122	. 97 79	66.4429	1.1462	.3825	. 6777	.0524
•	2.6823	.7474	, maza	46.47	76.5326	1.2351	.3645 .2563	.8599 .8221	.6565
•	?.3.55	.74*4	4475	. 1426	77.5504	1.6754	• 27 7 3	*4251	** ***

Figure A.5.- Continued.

7	2.55.4	.74 7	. 2913		73.6125	****441	.?2+3	. 7754	477
8	7. 76:5	21.31	.77	. 7744	72. 3554	1269	. 2312	.7425	. 474
•	1.12.1	. +45.7	7500	. 7777	73.224.	1 64 :	.2243	.7440	486
10	3.75.0	7 26	.77:4	741.7	77.5 2.	104:49	. ? ? 4 4	7525	:
11	3.41.94	.0440	.7979	. +221	73.3032	1.1637	• 236 ±	7967	532
12	7. 7241	270	-190		73.1631	1.2150	.2483	. #25#	9360
13	7. 05 64	1. 19.1	95.77	. FC36	71.00 174	5 - 20 - 2	.2011	.5464	579
14	4. 932	1.1412	. +987	. 5414	71.1471	1.3143	. 1041	*4003	
15	4.4277	2.72	. 945-	. 445.	7 . 9453	.3*92	. 3279	. 7398	. 621
16	4.6623	24 A	. 4947	10:4:1	74.020	: . 4 27	.2437	.240.	643
:7	4. + 4 + 1	1.7217	1.6955	1.1571	765.1	1.4409	.3627	1.3341	
19	*.1513		20.44,	1.1470	7	1.4414	.3327	1,0404	•c 677
19	4.3559	1.4775	1.1224	1.1710	7(.3123	1.5112	.400	1.12.2	69.
ADDITIO	THAL ATTAL L	PEATION NO.45.	47 Y/00 .	-2.5367					
Ť	0 /0	D/DINE	uloide	RIOTHE	R-ANGL F	9/9INF	RY/RTHE	SANSIME	47/51NF
		(PARALLEL)	(000)	(IN-DL AN-)	([N = 7[#N ?]	(MUSHAL)	{PESUETANT}	[PESULTANT)	(PECHETANT)
,	144;	.5" 55							
2	1.3561	.6457	1.42.4	3. 852	19.957	1.5337	2. 1267	.3712	• • 7C1
3	****	.6755	. 52: 4	Cric	56.3445	2.2410	.5341	. 1635	.0:67
4	1.67.1	.711A	. 936 -	. 4. 44	66.2543	1.1413	.3547	. **97	. 0522
•	2.1171	.7470	. 9165	.c341	72.07.6	1.10:5	.2573	. 6579	a L 56.3
6	2.3:4.	.7754	, p ~ 7	****	74.3733	1.0759	.2451	. 85 99	. 6 4 9 2
7	7.5961	.7894	. 5352	. F47F	74.45.7	1.462	.2213	. 4175	.0478
	2.8331	. 9. 75	. 743.	e* 74	73.9732	1.0340	.2227	,7742	473
9	1.16.3	.9464	. 744.		74.4476	1.4565	.21.1	.7779	.6443
10	3.3271	* 20,00	.7367	1 4 7	74.7-45		• 21 f Z	.7869	3
11	3.5641	.7513	• •1 02	. 6610	74.2047	1.1:22	• 55 64	9 92	. 6527
:2	3.1.5.	? 2 c	• ć ż 13	. *7 *4	74 75.	1.2035	.2465	.4434	. L 55 C
13	4.6453	i. :A39	. 7	• 91.72	72543	1.2573	.?751	.8622	.6:73
14	4.2921	1.1441	• 4. 34	• 04.	71.6379	2.3011	.2993	.0113	95
15	4.5321	1.2723	90	1. 36	7	2 + 3428	• 31 Ct	9609	.0615
16	4.7741	1. 2. 03	1121	1.0459	73946	389.	• 33 EA	1.7763	• . 635
17	5.1.53	1.3127	1. 224	1.1047	7155	1.4272	. 3: 74	1.5482	. 1 692
10	1.25.7	1.3668	40.365	1.1579	76.3259	144673	.3774	1.1933	*C 67T
Į a	5.54.2	1.4124	1.171	1.1.36	70.3451	1.4977	.303)	1.1.52	665

VELOCITY AND TIMPSPATHEE CONTOHES

14 ATFORITA LE EMBENELHOET CONTOUS FINEZ EDONO

Figure A.5.- Continued.

MAGNETIC FTELD CONTOURS

11 MAGNETIC FIELD CONTOUR LINES FORMO (FOR COMPONENT ALONG FIELD LINES PARALLEL TO FLOW IN ERESSTREAM)

thus Consident in the biffu fines standaillife to efun in esteristative)

25 POTRITS TH CONTOUR LINE OF REALINE (PERPENCECULAR) # 5-10;

Figure A.5.- Continued.

USHSILA COMECHIS

A DENZITA CUALUIIO FINGZ EDIMO

Figure A.5.- Continued.

14 MACHETTE FISHE CONTOUR LINES COUNT THE COMPONENT ALONE FISHES COUNTY TO FLEW IN CREESERAL TO POTENTS IN CONTRUE ITE TO PAPER ENGRALE . Select ¥ /0 . 1.7142 1.0310 1.4027 1.4027 1.4027 1.4027 1.4027 1.4047 1. .0677 .757 .757 .1117 .1117 .1177 .1177 .2547 .2547 .2547 .2547 4703 -5364 -5465 -5465 -7185 -7724 -8719 -8217 -8717 -9155 -9696 .6996 .6995 .6726 .5770 .5.79 31 STITE TH CONTROL CINC DE STATES (NORMAL) . 5.000 x/*0 9/46 1. '7-4 i.. (43) i.. (43) i.. (39) i.. 72 i.. (39) i.. 72 i.. (39) 22.5 23.732 24.732 25.732 25.732 26.733 27.744 27.724 27.724 27.724 27.724 27.7222 27.7222 27.7

Figure A.5.- Continued.

.08.4 .091 .046 .6361 .36.

TRAUECTORY COMPRESSES

		P /FPL+MET =	331						
•	241.4	¥ /01	٧/٥,	718.	R /P :	Y /P PLANET	Y/00L4F:T	*/RPLANET	R/PPL4NET
i	-01.47	10.2	-5.4124	1.5040	4.1175	1.3543	-2.7322	2.029#	4.2484
?	-44 .: 37 .	.9347	-3.4354		3.657.	. 7555	−?•5 550	7. *475	4. 792
3	-P*.2:3u	. 8440	-3.24,5	63 2	3.6.74	. 8778	-3.34%	1.6643	3,023
4	-74.67; .	. 75 . 5	-3 a. 36×	2 6	3.6417	. 7765	-3.137?	2.5756	3.7614
4	-7: •6 - 36	.6740		2 23	3.5/43	.5993	-2.9633	2."794	3.5 704
5	-44.2433	.5519	-2.6356	2.1135	3.2932	.58 5	-2.69.7	2. 18 15	3.412.
7	-57.t.2.	. 4431	-2.3274	2.0076	3.6700	. 4:78	-2.4/43	2.1692	3.1715
•	1.4.2.	•122*	-2347	67-5	2.636	• 3732	-2.2.2.	2. 1437	2.9319
۰	-47.73*.	*314c	-: • i· 7a	1.0066	2.4243	.1187	-1.5575	1.9413	2.5045
10	-33.60KG	4: 95A	-: •4° 73		?.3447	.,947	-1.5.55	1.9513	7.4646
11	-99.6070	.0446	-2.3737	1 764	2.37 6	. *58	-1.4.91	1.0372	2.3273
12	-3".435	. 197	-1.2437	1. 417	2.22.2	199	-1.2317	1.9721	7.2936
13	-94671		-1.1943	4.7247	20.414	9	-1.2336	1.4951	2.2537
14	-32.735.	(954	+: •0775	1.7975	5.4 95.4	,044	-1.1153	L. *5.7	2.1517
15	-24.2.2	+. 2. 9;	2757	100 Ze	1.7177	5:60	-45 35 6	1.5552	1.7596
16	-21.642:	2686	3796	445.54	4.:647	2774	?9.3	1.5696	1.6166
17	-15.73; 0	3475	1.5	i. ?>3c	1.3572	3: 39	1173	1.4311	1.4124
19	- 4.6.2.	3744	eu 291	1.2719	1.2723	3576	.7299	4.3141	1.3143
19	-11.4620	4754	•:7>.	1.1121	1.125*	4201	* j 4 · b	4 9 9	1.2536
24		45;3	.4375	95.10	1.(120	4663	•4521	. 9435	1.0445
51	-4.9 . 4	46 %	. 5 5 4 7	•t277	•6.39	4935	.5764	. 4597	• 9442
22	4.244.	356	.2634	?: 64	1.6220	3479	1.622:	2570	1.6758
23	0,406.	2454	11 62		1.237.	-,29:9	1.0376	5459	1.1746
24	17.5430	2104	.9942	77 5		-,2174	1.027;	4715	1.3778
25	17.3432	0837	.0116	-1.1756	1.4657	1965	.9624	-1.2522	1.5 .9.
26	20.127	•233,	.5557	-1.5260	1.9434	.2407	.6577	-1-9964	2.0778
27	24.4461	. ? 7 ? ?	.5175	-2. 451	2-1493	.3425	.5346	-2.1543	2.2194
24	43.60	.531	.3324	-2.3444	2.7477		.343/	-2.4426	₹.456€
29	47.2e	+647.	437	-5.46	2 . 5 = 6 *	.7 45	.1444	-7.4652	2.6723
30	53.et(;	. 62 95	;479	-5.6565	3.2395	. 17.57		-2.9224	3.9535
31	14.762		1435	-2.9317	2.4352	. 9265	2447	-3.0284	3.6322
32	59.5930	.9448	2004	-2.99:4	3. 26	9767	2:36	-3945	3.1718
33	A2 =1 6C 2	. 96 71	2395	-3.7253	3.1 377	. 010	2454	-3.1784	3.134.
34	52 53	1.0225	*•3 15	-3.0 1	3.1940	1.3463	3116	-?.1923	3.2775
35	47.2260	1.1229	- • 46 . 3	-3.237:	3.267	10.00	4755	-7.3440	3.3776
35	73,4245	1.2494	54:	-3.1973	3.4.9	1.2967	6657	-3.5106	3.5793
37	97 .32c.	1.372	63.6	-3.4400	. 3.646.	1.4.84	6245	-3.6573	3.7556

CETTY EXITY AND MACHITIC EIGHD COMPONENTS ALONG TRAISCOCKY

(A)M-DimeralDatfistD as IntiabltMatas Affilia)

4	3417	V / V1 4 F	44/4146	4414146	V7 /V [NF	041/0471 <i>m</i> e	TEMP/THPINE	ulaide	44/#THE	RY/SINF	BI/BINE
1	-70.57.	2393		16	را بالمام	403.11	2000	2.40))	.1464	.9890	.0457
Z	-45.5370	1.0000	1.0336	ويانانوو	Johnson	1.003)	in Cas	206633	-1434	.989u	.0457
3	- ** • 2 (3*	a et al.		4 . 1 6 .	1.6330	1.0363	1.0000	1.0633	.1404	.9893	457
4	-74.9763	4.00	2011.	0.000	10. 10.		Banking a	2.0000	.1404	.9890	.0457
5	~72.5C3C	1., 194	Levi.		Jac 138	1.65399	1.33.44	1.0000	.1404	.989u	.3457
6	-54.2636	1.6290	200.00	3,418 (3	10.000	Levil.	200 62	1.0007	.1404	.9890	.0457
7	-57.4371	1.6306	1.000	J.CCu.	*****	10. 12.	A a a b a sa	400643	-1454	.9890	.0457
•	-51 .41 21	1.(31)	1.0000	0.0000	2.0030	1.0000	1.0000	1.00	.1404	.9890	.9457
9	-4 735.			30.16	(636	1.0000	1.0000	1.660)	.1404	9893	+0457
10	-30.668	i.cors	3.46.	Janney.	166 336	2. 221.	1.7600	1.00.0	.1404	9890	457
11	-38.5(27	310		Section 5	J. CC 30	1.0030	1.0000	1.0000	.1404	9890	.3457
15	-15.0351		40414	5 6 3 5 4	40.0	10	40.114	1.0000	.1404	9890	.0457
11	-34.9676	1.0000	1.6000	1,6201	2.0030	1.0111	40053	1016	1404	9894	.1437
14	-37.735.		• 7363	-• 1435	. 2334	2.2747	2.1790	2.0935	61?	2.6363	.4687
15	-24.212:	.741"	.7294	,541	. 7651	20.497	2.4642	2.2455	0223	2,2119	4032
15	-21.34.2	. 756A	.7115	2692	.2775	2.072	2.21.9	2.3575	.3794	2.3341	.3513
17	-16.735.	. 7445	.6434	23.	295	1,0225	2.1373	7.5864	1469	2.5720	.2303
19	-14.4626	733*	•6¢ a.	41.164	.3.35		2.3846	2.7636	.2707	2.7472	.1311
10	-11.4620	. 7200	. 64:1	* * ± ./L	.1.79	:.7559	2.4410	2.2855	45542	3.2390	0556
20	-9.1 520	77.92	. 6:45	.1492	.34	1.7512	2.49.1	4.565	1.6565	4.2664	6335
21	-4.9640	U. C200	C.0)Lu	10.000	1.6636	7.630*	40 11 14 3		99190	Callut	00-6
22	4.294	.756.	.61.4	. 1154	- SHR!	1.5244	2.2654	3.9879	7.1313	2.3617	.7219
23	9.4980	.771!	.74	. 2632	1385	1.5137	2.2164	3.1617	2.1-19	2.1275	.8425
24	17.*930	. 73 27	. 7329	.21.55	:716	1.4379	2.1575	2.5055	1,3796	1.9715	.7097
29	17.3930	. 2794	.7:70	.1647	: 999	1.6/35	2 701	7.2091	.8413	1.9744	.5383
25	29.1270	. #3 47	.7997		22 47	4.7579	1.7135	2.654	. 3976	2.6622	.2647
27	34.461	.*405	·+115	• 05 97	-,2336	1.4313	1.9505	2.0425	.3221	2.46.69	-179u
24	47 . 461 .	e5 * 4		. 333	2365	1.0021	1.9027	2.0259	.2692	2.4656	.0974
29	47.25.	. Po 26	. 8297	131	2754	1.941)	1.7675	2.0042	.2307	1.99.6	.0342
30	53.66JL		and with	40.00	Parte.	1.0773	1.0000	1.0000	.1404	9890	.0457
31	56.0620	1.000		()		10:1:33	2.16.16	Lengua	.1404	.9890	.0457
27	50.0030	1.0000	1.0000	Section	3.6636	10:15:	1000 100	: • (L 17	.1404	9896	.0457
33	Stoubut		1.0663	C. CLGO	0.00:-	1.0000	1.2630	1.7007	.1464	9890	.0457
34	62.153L	1.5747	1.61.6	Setudo	*****	1. 1.35	1.0000	1.0010	.1404	.9890	.0457
35	67.5280	oor	1.000	9.000J	C.000L	1.5000	1.0000	1.0000	.1404	.9896	.0457
36	73.926.		i. 1		1011111	1. 077	1.3000	1.0000	.1404	9890	.0457
37	*0.7260	1.0000	1.6.00		• C (* 3)	1.r 55	1.3053	100 655	.1404	.9890	.0457

Figure A.5.- Continued.

FLOW FIELD AND MAGNETIC FIELD COMPONENTS ALONG TRAJECTORY

(SOLAR WIND COORDINATE SYSTEM)

(DIMENSIONAL, USING IMPUT INTERPLANETARY VALUES)

		INTER-LANETARY MACH NUMBER = 3.30		INTERPLANETARY MAGNETIC FIELD MAGNITUDE = .002E+31							
			SPECIFIC 4E		1.6567						
			ETARY VELOC		3.920E+02		ONERT - 1.2				
			ETARY DENSI		2.0238+31		DNENT - 4.7				
		INTERPLAN	ETARY TEMPE	RATURE =	1.023E+05	S-COMP	DHENT - 4.0	32E-01			
M	TT#E	141	٧×	٧٧	٧Z	440	TEMP	191	AY	BY .	92
1	-93.8700	3.9266+92	3.9266+02	c.	3.	2.020E+11		8.823E+00	1.239E+00	9.726E+UU	
ž	-95.5374	3.92(E+02	3.920E+uZ	δ.	٥.	2.020F+01	1.020E+05	9.423E+00	1.2396+00	9.726E+00	
3	-40.2030	3.9206+02	3.920E+42	0.	0.	2.0208+01	1.420 6+05	8.823E+00	1.2396+00	*• 726£+03	4.032 6-01
4	-74.8700	3.920E+C2	3.920F+02	6.	0.	2.0206+91	1.020F+05	0.8236+30	1.239F+27	9.7262+30	
5	-70.6630	3.92LE+62	3.920 5+02	0.	٥.	2.5205+01		8.823E+00	1.2396+00	9.726E+35	4.032E-01
6	-64.2630	3.9266+02	3.92CE+02	C.	G.	2.020E+01	1.0205+05	0.8236+60	1.2398+00	9.726E+UL	4.C3ZE-01
7	-57.8K2-	3.92(E+02	3.920E+02	0.	0.	2.0206+01		0.823E+30	1.2298+05	9.7266460	
•	-51.4022	3.9205+02	3.9207+02	6.	D.	2.0505+01	1.0206+05	8.553E+00		9.726E+0G	
9	-40.7350	3.9206+02	3.9206+42		0.	5.050E+31		P.P23E+96	1.239E+00	P. 726E+06	
10	-39.6680	3.92 CE+02	3.920E+¿Z	ű.	Ç.	2.0207+91		8.823E+00	1.239E+03	1.726E+00	
11	-38.6C20	3.92GE+02	3.9266+42	L.	c.	2.0205+01		8.823E+00	1.239E+00	8.726E+0G	
12	-35.9350	3.92 CE+02	3.920E+02	0.	6.	2.020F+91		9.653E+76	1.534E+00	9.720E+0	
13	-34.8675	3.92(6+32	3.92(·E+u2	0.	Ç.	5.0505+01		0.023E+00	1.239E+93	9.726E+LL	4.632E-01
14	-32.7356	3.1376+72		-5.6272+41	9.3436+01	4.5955+91			-5.400E-01	1.797±+61	4.135E+00
15	-24.2020	3.0652+02		-3.717£+01		4.1798+01		1.954E+91	-1.970E-01	1.951E+L1	3.557E+00
16	-21.0L2C	3.006E+02		-2.744E+11		4.055E+01		2.080E+31	1.7296-01	2.0571+01	
17	-16.7350	2.918E+02		-9.363E+36		3.843E+01			1.295E+9G	2.269E+01	
18	-14.6626	2.8772+02	2.619E+02	2.710E+00		3.7996+01	2.4326+05	2.438E+01		2.424E+U1	
19	-11.4620	2.8266+72	2.529E+u2		1.246E+62	3.62#E+01	2.490E+05	2.93CE+31	4.890E+30		-4.856E-61
2Ĉ	-8.1620	2.7865+72	2.428E+02	5.847E+01		3.5376+31	2.5416+05	4.027E+31	1.461E+01		-5.589E+00
21	-4.9000	c.	c.	6.	D.	0.	0.	0.	7.	0.	
22	6.2980	2.9646+02	2.673E+62	1.2365405	-3.232E+61	3.0396+31	2.331E+05		2.7636+01	1.6776+01	6.369E+G3 7.433E+Q3
23	9.4980	3.0232+92	2.789E+ú2		-5.427E+01	3.056 E+31		2.789F+.1		1.7396+01	
24	12.5930	3.0722+62	2.9736+02		-6.699E+01	3.107E+01		2.210E+01		1.7356+01	
25	17.3930	3.138E+92		6.457E+31		3.239E+01	2.12)E+95 1.942E+05	1.9495+01	7.422E+00 3.508E+10	1.7668+41	
26	29.1270	3.2775+02	3.135E+02		-8.965E+01	3.571E+01		1.7306+91	2.842E+30	1.7716+01	1.579E+03
27	34.4664	3.3188+02	3.181E+02		-9.164E+(1	3.6996.01	1.839E+C5	1.7576+31	2.375 8+30	1.7696+01	8.5976-01
28	40.8600	3.355E+02	3.222E+02		-9.271E+41	3.942E+31 3.921E+31		1.768E+J1	2.035E+00	1.7566+41	
29	47.2666	3.3825+02	3.2525+02		-9.2456+61			8.8236+00	1.2396+00	9.726E+0G	
30	33.6666	3.92CE+02		ç.	D.	2.0206+91	1.0205+65	8.8236+30	1.2398+36	9.7266+66	
31	56.862G	3.9205+02	3.92CF+02	ć•	0.	2.020F+01		8.823E+00	1.239E+00	1.726E+Lu	4.632E-61
32	58.4930	3.9208+72	3.926 6+62	ù•	0.	2.02CE+01 2.02CE+01		4.823E+00		5.7266+00	
33	60.7660	3.9262+72	3.9205+62	֥	Ç.	2.0206+01		8.823E+00	1.2396+00	8.7268+00	
34	62.1936	3.9206+32	3.9206+52	j.	ŗ.	2.0202401	1.0206+05	8.823E+00	1.2398+00	7.726E+U0	4.032E-C1
35	67.5280	3.9266+72	3.920E+G2	Ç.	6.	2.026 6+01	1.0201+05	8.023E+20	1.2396+20	7.7268+00	4.0326-01
36	73.9280	3.9206+92	3.920E+G2 3.920E+G2	0.	: ·	2.020E+01	1.620[+75	5.823E+30	1.2396+00	9.726E+GC	4.632E-c1
37	90.3280	3.920E+02	144205402	c.	••	240202401	20000000	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			

TRAJECTORY CALCULATION

TRAJECTORY COOPDINATES

	,	G/RPLANET =	1.0331						
N	TIME	X/PG	Y /RS	Z/RC	R/Pa	Y/RPLANET	Y/RPLANET	7/RPLANET	RIPPLANET
1	-90.8763	8160	3.6658	1.9621	4.1579	8430	3.7876	2.0270	4.2954
ž	-95.5370	7405	3.4848	1.5796	4.0076	7650	3.6630	2.0450	4.1463
ì	-83.2433	6621	3.2644	1.9960	3.8434	6840	3.3936	2.0620	3.9754
- 1	-74.8760	5806	3.753	2.667	3.6721	6000	3.1770	2.0730	3.7935
Š	-70.6030	5159	2.9430	2.6115	3.5318	5330	2.9990	Z.0780	3.6486
6	-64.2430	4162	2.6339	2,6125	3.3140	-, 4300	2.7210	2.0790	3,4243
ž	-57.8023	3136	2,3493	5.6369	3.6459	3240	2.4270	2.0673	3.1979
i	-51.4020	2101	2.0502	1.9776	2.6456	2170	2.1180	2.0437	2.9427
ė	-41.735C	0329	1.5126	1.6982	2.4268	0340	1.5626	1.9610	2.5971
10	-39.6683	0165	1.4607	1.8886	2.3675	0170	1.5090	1.9510	2.4665
11	-39.6620	3097	1.3765	1.8762	2.3221	0100	1.4220	1.9320	2.3989
īž	-35.9350	.0474	1.240.	1.8411	5.2198	493	1.2810	1.9020	2.2732
13	-34.8670	.0649	1.1926	1.8256	2.1696	.0670	1.2326	1.0960	2.2527
14	-32.7350	.1529	1.0725	1.7927	2.6891	.1500	1.1080	1.0520	2.1581
15	-24.2620	.2377	5640	1.6125	1.7083	. 2456	.5826	1.6659	1.7647
16	-21.6623	. 2859	.3629	1.5191	1.5616	. 2954	.3749	1.5693	1.6135
17	-16.7355	.3446	.0871	1.3639	1.3667	. 3560	.0900	1.4090	1.4119
18	-14.6020	.3698	4553	1.2729	1.2739	.3020	0526	1.3150	1.3160
19	-11.4020	.4017	1984	1, 1132	1.1337	. 4150	2050	1.1500	1.1681
20	-0.1C20	. 4230	4627	.9148	1.0251	.4370	4780	.9450	1.0590
21	-4.9000	.4279	6805	.6399	.9334	• 4420	7630	.6633	.9643
22	6.2984	.2991	-1.0007	-, 25 75	1.6410	.3090	-1.0426	2660	1.0754
23	9.4980	.2294	-1.3212	5285	1.1499	.2370	-1.0556	5460	1.1979
24	12.5933	.1549	-1.3048	7754	1.2692	. 1600	-1.0380	8010	1.3111
25	17.1930	.0329	9351	-1.1248	1.4627	. 0340	9660	-1.1620	1.5111
26	29.1276	2662	6515	-1.6266	1.9393	2750	6736	-1.6870	2.0734
27	34.4600	3940	4956	-2.0860	2.1441	40 70	5120	-2.1553	2.2156
26	40.8603	5430	3020	-2.3658	2.3850	5610	-,3120	-2.4440	2.4638
29	47.2603	6824	1045	-2.5846	2.5867	7050	1086	-2.6700	2.6722
30	53.6600	8170	.0951	-2.8314	2.8330	8440	.0 982	-2.9250	9956
31	56.8620	8809	al 946	-2.9340	2.9405	9160	.2010	-3.0310	3.0377
32	58.9930	9235	.2604	-2.9979	3.0092	9540	2695	-3.0970	3.1297
33	60.6600	-,9438	.2933	-3.0308	3.0450	9754	.3030	-3.1316	3-1456
34	62.1930	9854	.3591	-3.0928	3.1135	-1.0180	.3710	-3.1950	3.2165
35	67.5260	-1.0863	.5237	-3.2399	3.2819	-1.1220	.5410	-3.3470	3.3904
36	73.9260	-1.2013	.7154	-3.4016	3.4784	-1.2410	.7390	-3.5140	3.5909
37	80.3280	-1.3136	.9090	-3.5535	3.6679	-1.3570	.9396	-3.6710	3.7992

Figure A.5.- Continued.

(clin=ofa4f1 Cusotingtc cAc2f4) efun el-fu and meckitic elifu Cussunintc afunc dealicatuss

ENON-DIMINGROUPLEFED BY THISPPEANATARY VALUES

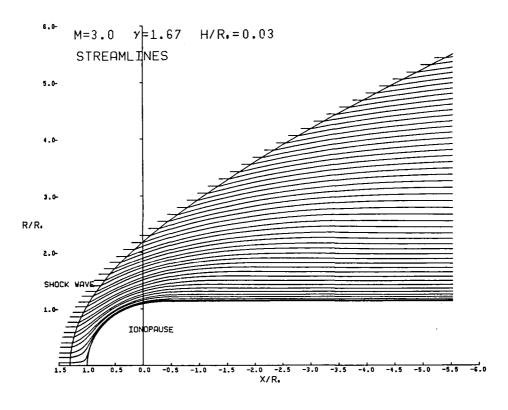
N	TIME	Alalas	MAINLAS	AAAAIde	4.141#8	047/047745	Tampstmaine	4/414-	JAVelde	#Y/FINF	RZ/RINE
1	-9' - 27.		-, -, -, -, -, -, -, -, -, -, -, -, -, -	es 575	1126	1./***	1.3000		1572	0793	453
•	-45.437		- 600+ 3	. 175	26	1.0000	1.7666		1972	6743	.0453
3	-45.2.30	40.00	99 - 3	4.574	1 26	1.010		10.63.	1972	9793	ol 453
4	-74.47.		9913	7 .	6626	1.0000	1.0000	407631	+.1979	5793	a5 453
- 5	-77.fu3c		9563		2t	1.		1.0022	1979	9793	.0453
5	-64.7631	10000	GCA3	.1 574	-oti2e	244, 197	40.1	1.0	1972	9793	eu 453
7	-57.912.	**	07:3	• (: 75	1,26	401 17	1.366.	Acceptance	157?	9793	. 453
•	-91.412.	406.00	9513	. 15.75	1 26	1.0	4.	1. "	:972	9793	.0453
9	-40.735.	40.54	95F 3	• 5 7 >	26	2.6530	1.0000	1000	1972	9793	453
1.0	-39.465.	200.20	0063	74	+.1 . 26	1.0000	1.5000	1.0000	1972	9793	.453
11	-30.6(20	1.113	6943	• : 7t	24	2.4. 33	1.000	40 0	1979	9793	.0453
12	-15.0350	1.0000	59.3	• 1 : 75	÷e: 25	1., 37	1.0000	1.5000	1972	9793	453
19	-34. 247.	A 36	-,99-3	• 575	26	1.	1	10000	19??	-, 9793	.0453
14	-37.7356	. 2362	7414	. 1 605	. 2354	2.2747	2.179	2.64.5	2573	-2 at. 364	.4688
11	-24.21.2	.741.5	7:44	.1367	.2571	2045 47	2.16-2	2.2495	1:6ì	-2.21.95	.4032
16	-21 · "< 2.	. 74.4.0	7 7_		. 2757	2 72	5,5370	7.357*	1547	-2.3261	.3512
17	-16.731.	. 744*	5-14	. 624	. 2992	1.9225	2.3373	2.5864	- 5 6 2 5	-2.5592	.230C
16	-14.51 2"	.7332	644.	. 315	.3(1)	1.4274	2.3245	2.7435	42 17	-2.7273	.1304
19	-13.442.	.7230	6477	: 47	.2154	1.7059	2.4416	3.2955	7195	-3.2617	0565
2:	-8.1(2)	.719*	6274	::3?	. 30 96	1.7512	2.4911	4.565.	-1.5942	-402641	6378
21	-4. P. L.	1 6 C Jul	• 6 2	** i + 7	\$4.000 c	0.0.133	0.000	(.00)	3.0303	inclia	J. 1000
22	5.298.	. 7> 6*	65#7	2761		1.5144	2.2854	1.9877	-3.2639	-2.2774	.7137
53	9.498.	•77:1	7:3.	2213	:403	1.5100	2.2144	3.1617	-2.3029	9982	.236#
24	17.5935	. 79 37	742 *	765	72.7	1.5779	2.1575	2.5055	-1.4857	-1.6891	.7061
25	37.1924	.5374	7653	1269	2 :9	35	2.7#1	2.2.41	9547	-1.9166	.5361
26	20.127.	. 736	9(25	1377	7376	1.7579	1.4635	2+1 594	5129	-1.9759	.2636
27	34.461	45 *	*:2 -	112	??39	1213	1.451.5	2 4 . 4	4376	-1.9850	.1782
24	41 . 46	. 65 5 5	A218	+ 31.43	2337	1.9121	1.2627	2.6259	3*44	-1.9668	ey 967
20	47.251		F2 n 4	. 345	23	. 9413	1.7675	2.0042	3450	-1.9740	.0336
30	53.5666	1.6.33	9593	• 174	-41 26	301-233	30-145	1.:	1972	9793	.0453
31	55.062	1.0000	6443	75	20	1-1-72	10,115	1.00	1972	9793	.0453
35	59.993.	1000	99-3	75	25	2.0030	A.C.	1.0000	197?	9793	.0453
?3	60.7666	1.000	CCA 3	75	(, 26	1.0/37	1.0	1.000	1972	9793	•0453
34	95.763.	• "	97-3	• \ 5.75		1.0033	1.9660	1.0000	1972	9793	. 1453
35	57.52F.	• •	- acl 3	• • 7•	26	•	1.3600	1.6000	1972	9793	.6453
36	73.924.	4.503	5 6 5 3	• : 75	** 26	1	1.7500	1.5500	97?	9793	.0453
37	90.320.	1.6	6613	76	2 t	241.13	1.0000	1.0000	1972	5793	.0433

(SUM-5) AND COUNTRY CASEA) FROM EITHO WAS MASH'ITE CITICS CONSUMENTS MESHE ISABECTORY

EDIMENSIONAL, MAINE IMPHI INTERPLANETARY ANTHERS

				TOTAL MALE	AND ALLIAN D	dadi latina	CTAFIGNA AN	F1167.1			
		PATED DE INTERPLAT	METADY MACH SPECTETO H NETARY V:LOO NETARY TOMP: TANGLE	- 1001445	5. d 1.6557 2.92754)2 2.0257404 1.15464	443NTT 4-0740 4-0740	Natary Magn UDF = .F ONENT =-1.7 ONENT =-6.6 ONENT = 4.0	#25+17 492+30 432+30			
		POLAS AN			• 15 J5 • 26						
4	T1*E	/ 4/	44	٧٧	٧7	३ भ∩	TEMP	/8/	44	*5Y	92
1	-91.4761	3.9206+12	-3.913:+.2		-1 . /26 c++4		********			-9.6446+40	4.5606-61
•	-95.537.		-3.613(+-2		-1.J?fi+L.	2+0205+31	1.3236+45			-4.64L E+uu	4.6vu E-01
3	-47.7636		-3.9131+12		-: : 66+. !	2. 2.5+31	10-31-51-65			-8.640E+00	4.C00E-01
4	-74.9700		-7.913-+32		261+ '	2. 2054,1	1.1225005		-1.749 -17		4.000E-01
5	-71 51 3.		-3.913:+62		-1 Ebt+14	22 :+):	1.3205+35			-9.64LE+60	4.000 E-01
6	-64.2631		-3.9:3/+.2		265+44	2 . 2 - + 11	1.0278+45			640E+00	4.000E-01
7	-57.4120		-3.9135+62			2.520.401	2.02-14-5		-1.740F+33		4.000 E-01
	-51 4412		-3.3.36.2			2.0205+31	?):+05		-1.7405+20		4.Luu E-ul
9	-47.735		-3.0.356.2			20.27501	- u 2 . F + 1.5			-9.646 8+60	4.000E-01
12	-39.664		-3.913:+12		-10.26:00	2.72r2+L.	1.4236+65			-9.644E+40	4.0006-01
11	-38.602° -35.935°		-1.913E+ 2		-1.1268+11	2.2.5+11	1.4215+45			-9.64CE+00	4.000E-01 4.000E-01
12	-17.4351		-3.9135+1Z -3.9135+0Z		-1.0265+66	2.020*+31	1.7275+35			-9.64LE+LU	4-6005-01
: ;	-52.735.		-2.9.6.+.2		9.2067+11	4.5955+01	7.121:+0			-1.7976+61	4.136E+03
i	-24.2.2.		-2.7367+.2			4.179:+1:	2.2176+15			-1.949E+L1	3.557E+00
14	-21.1.2		-2.772-+.2		1.0916+02	4.0555+01	2.2715+35			-?.u52E+01	3.4996+60
17	-15.7355		-2.671.4.2		1001,2002	3.4835+13	2.18+E+c5			-7.25 bE+61	2.029E+00
19	-14.602		-2.6195+2		1	3.7996+11	2.432*+-			-2.4666401	1.150E+00
	-: 1.4.2		-7-530:+02			3.5246+01	2.493[+35			-2.625E+U1	
20	-92		-7.4526+42		1.214:4.2	3.537E+11	2.5416+.5			-3.6216+01	
51	-4.0()	701002732	6.			5.	Ü.	3.	1.	-300022102	8.
22	6.2981		-2.72942			7. 3193+31	2.3316+05			-1.921E+01	6.297F+00
21	9.4060		-7.P47:+ 2			3. 45 10+12	2.2616.465			-1.763E+01	7-3636+00
24	12.553.		-2.916F+U2			3-1777+31	2.2016+0			-1.007L+01	6.230E+00
25	17.3936		-1.L: tt+12			3.2395+12	2.1206+75	1.9496+1	-9.423E+00	-1.693E+01	4.730E+60
26	29.1270		-3.1461+02			7.5717471	1.942 * + 15	1.7166+01	-4.525E430	-1 . 743E+UL	2.326E+00
27	34.46	3.3186412	-3.1261+62	-4.4396+96	-9.2476+61	3.6996+71	1.0005+35	1.4006+31	-3.961E+3:	-1.7518+01	1.5728+00
2#	4" . 866.	3.3555+*2	-3.2221+.2	5.514L+.	-9.3558+4.4	3. P42#+01	1.939[+05	1.7375+01	-3.3926+0^	-1.753E+J1	0.535E-01
29	47.26.4		-3.247:+62		-0.3365+-1	3.9215+01	1.8036+05			-1.742E+61	2.9626-01
30	.3.66.		-3.913:+22			5.0205+01	1.0205+05			-9.64CE+00	4.COGE-01
31	56. 4626		-1.0,26+, 2		-10.201+44	2. 2. 5. 7.	1.721:445			-3.640E+00	4.300E-01
3.5	56.0430		-9.913[+62			2.02.5+31	1.0256435			-9.6448+03	4-4368-61
33	57 • 761 1		-3.7134+C2		-1.0262+06	2.3236+31	1.0205+35			-4.64CE+00	4.000E-01
34	42.1933		-3.9136+62			2.6205+71	1.3235+45			-9.644 6+46	4.COCE-01
35	57.5280		-3.913: -02		-1.6266+00	2.020E+31	1.0237+05			-# - 640 E +UU	4.033E-01
36 37	73.920		-3.9:3:4 /2		-1.0261+0C	2.0202011	1.0205+05			-1.64CE+CO	4.000E-01 4.060E-01
3/	47.3266	347252412	-3.9:2[+ 2	2025/2450		70.515.473	167517405	0.6525400	-10.405400	- 100 405400	410005-01

Figure A.5.- Concluded.



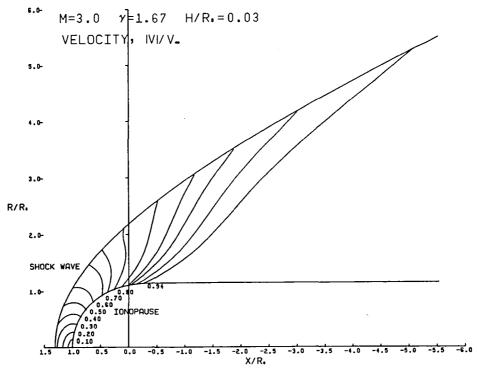
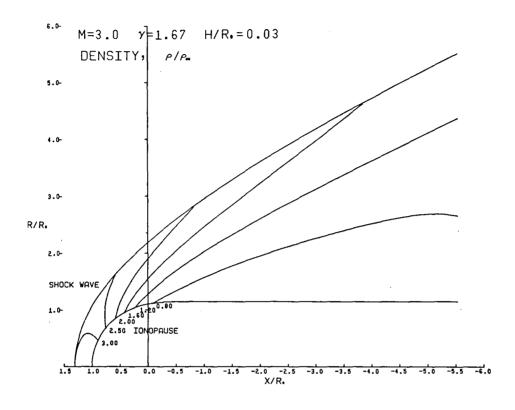


Figure A.6.- Plot output for sample case.



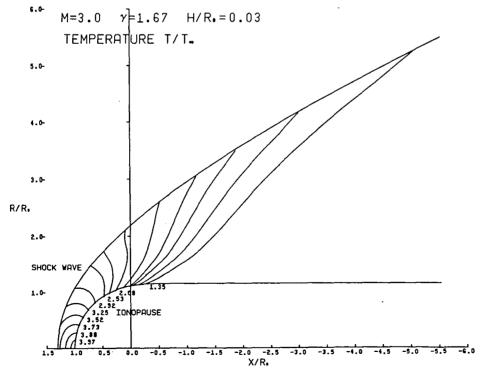
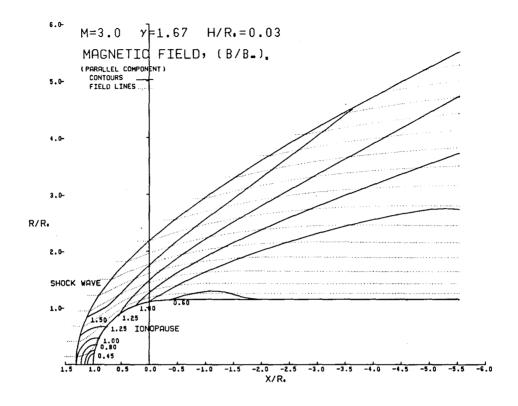


Figure A.6.- Continued



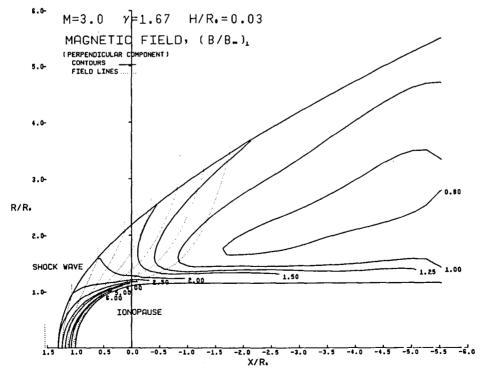


Figure A.6.- Continued

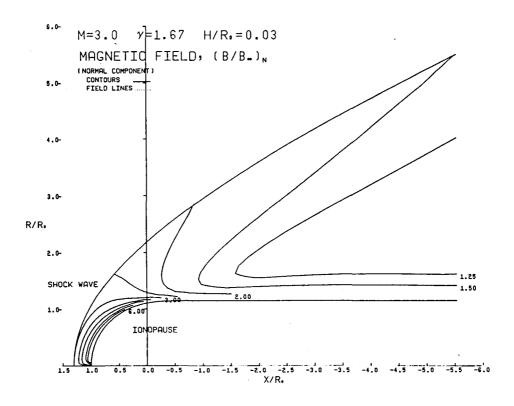


Figure A.6.- Continued

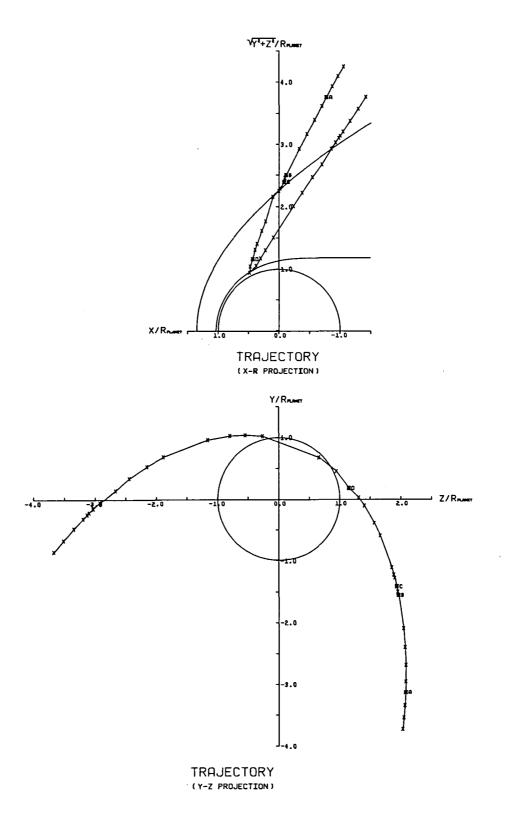
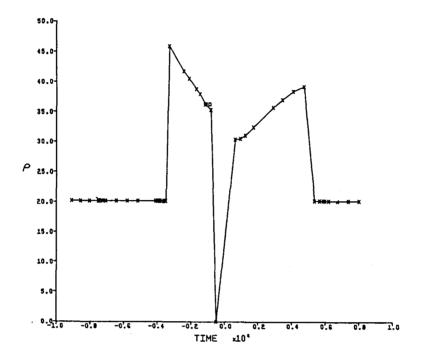


Figure A.6.- Continued

DENSITY vs TIME



TEMPERATURE vs TIME

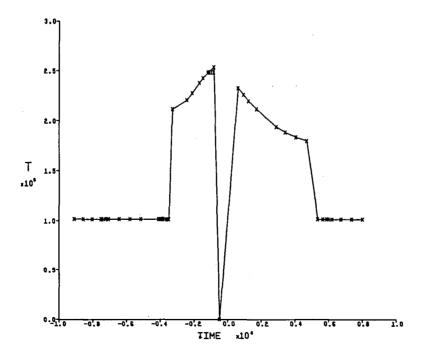
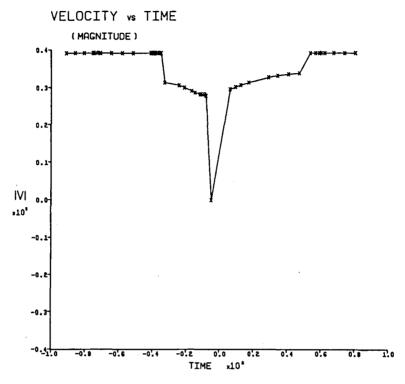


Figure A.6.- Continued.



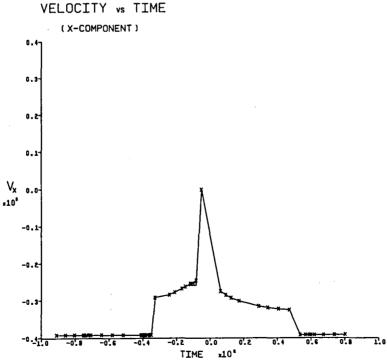
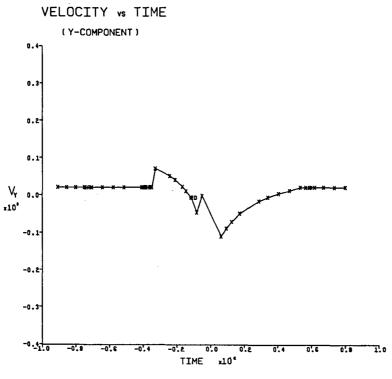


Figure A.6.- Continued



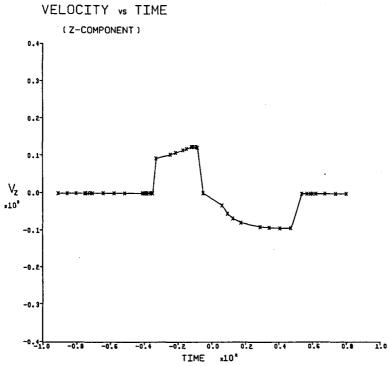
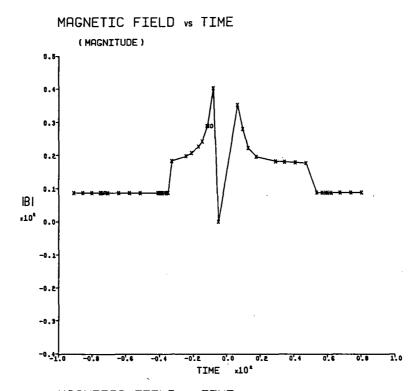


Figure A.6. - Continued.



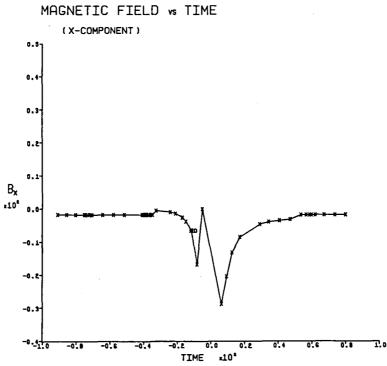
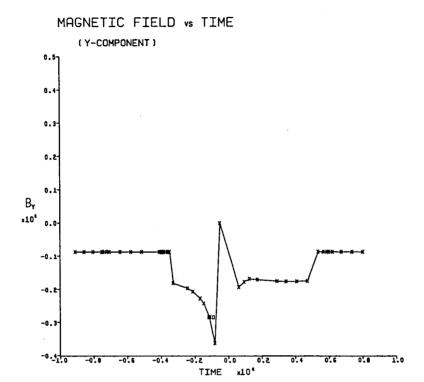


Figure A.6.- Continued.



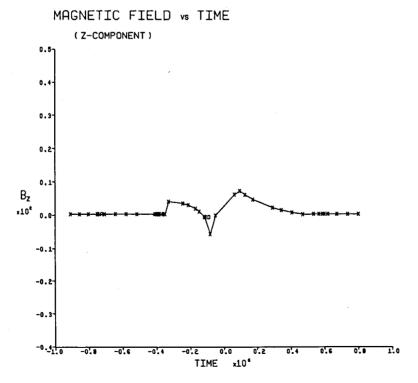


Figure A.6.- Concluded.

APPENDIX B

LISTING OF COMPUTER PROGRAM

```
PROGRAM MAIN (INPUT)OUTPUT, TAPES-INPUT, TAPES-OUTPUT,
TAPEI, TAPE4, TAPE91
                                                                                                                                                                                                                                                        42 ELLINFOEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                              GAMEL-ANG
PETURN
           'LIATELDIAFENDIATEN
LIATEGAL LPERUM,LPREFLLPBET,LPREGN,LPRA,LPLOT,LTRAJ,LRSTRT
COMMON /PROPT/ LRERUM,LPPFL,LPRST,LPREGN,LPRAJ,LPLOT,LTRAJ,LRSTRT
                                                                                                                                                                                    MATN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   34
                                                                                                                                                                                     PROPT
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANCEL
                                                                                                                                                                                    PROPT
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   36
37
                                                                                                                                                                                                                                                              IF POINT IS ON AXIS USE LINEAR INTERPOLATION
                                                                                                                                                                                     44 TM
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
            W#TTE (6, 2001
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   38
           CALL ECHINP
#FAD(5,100) NCASE
                                                                                                                                                                                     MATM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   39
                                                                                                                                                                                                                                                               Y-YCLT. 31
                                                                                                                                                                                     MATN
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
           TO 25 TCASE +1, NCASE
                                                                                                                                                                                                                                                               TF 11 .GT. 1) GO TO 201
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   41
42
                                                                                                                                                                                                                                                               N-MAF(1)
                                                                                                                                                                                    MATN
                                                                                                                                                                                                               10
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
            IF (LRERUN) 60 TO 10
                                                                                                                                                                                                                                                               90 110 K=1.N
                                                                                                                                                                                     MATH
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
           CALL REUNTS
                                                                                                                                                                                                                                                               IF (X .LT. X9F(1.K)) 60 TO 129
                                                                                                                                                                                    MATH
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                               12
13
14
15
16
17
                                                                                                                                                                                                                                                    110 CONTINUE
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   45
46
47
          AO TO 15
CALL REPUN
                                                                                                                                                                                                                                                    120 ELLINF-ELBF(1,K-1)+(Y-YBF(1,K-1))+(ELBF(1,K)-ELBF(1,K-1))
                                                                                                                                                                                                                                                                                  /(XBF(1,K)-X8F(1,K-1))
                                                                                                                                                                                     ....
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
          CONTINUE CALL FLOWST TE (LPREL) CALL FLOWST
                                                                                                                                                                                                                                                              GAMEL -ANG
                                                                                                                                                                                     PAIN
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                    MATH
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
           IF (LPPST) CALL STOUT
                                                                                                                                                                                                                                                              TF POINT IS AT X-ZPLOT, USE LINEAR INTER-CLATION
                                                                                                                                                                                                               19
                                                                                                                                                                                     MÄİN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   52
53
54
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANCEL
            IF (LPRS) CALL BOUT
                                                                                                                                                                                                                                                   263. TF (J .LT. NXHAX) 69 TO 309
                                                                                                                                                                                     MAIN
            CALL CONTUR
                                                                                                                                                                                                                                                               MIMONAF(3)+1
                                                                                                                                                                                   HAIN
                                                                                                                                                                                                               22
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
             TF (LTRAJ) CALL TRAJEC
                                                                                                                                                                                                                                                               77 210 TH=3,NST
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   55
56
57
58
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
   23 CONTENIE
                                                                                                                                                                                                                                                              TH= TH+1
                                                                                                                                                                                    HAIN
                                                                                                                                                                                                               24
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                               N=N=F {TH1+1
                                                                                                                                                                                                               26
27
28
29
                                                                                                                                                                                                                                                               IF IY .LT. RAF(IN, NI) GO TO 220
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
  16-J. FORMATETISS
MININ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   5 0
60
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                             CLUMIFORE CONTINUES OF THE CONTINUES OF 
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   51
62
                                                                                                                                                                                                               31
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   63
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                               33
34
35
36
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   65
66
67
69
        220 ELLINFOELOFCIM, NIMI+(Y-PBF(IM, NIM))+(ELOC(IM, NI-ELOF(IM, NIM))

    /(*FF(IN,*)**PAF(IM,*IM))
    GAMEL**GAMRF(IM,*IM)**(IM,*IM))

                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                37
                                                                                                                                                                                                                                                                              /(PAF(IN,N)-RBF(IM,NIMI)
                                                                                                                                                                                                                                                                                                                                                                                                                                       AMBEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   69
70
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                3 Q
4 Q
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   71
72
                                                                                                                                                                                                                                                              INTERTOR POINT - USE QUADRILATERAL INTERPOLATION
                                                                                                                                                                                                               41
42
43
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   73
74
75
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                   303 NI=NRF(1)
                                                                                                                                                                                                                                                              NS=Nde(124+1)+1
UU Q,U 121=1*A21
NdYA=Nde(3)+1
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGE
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   76
77
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                              IF (NZ .GT. NMAX) NZ-NMAX
N=MINO(N1,NZ)
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   7 9
7 9
                                                                                                                                                                                                                                                              Naminut napol.

nn 31: JJ=1,44

TE (X +LT - X5E([CT+1,JJ1) GD TD 340
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGER
           SURROUTINE ANGEL (ELLINF, GAMEL, I, J)
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                                                                    310 CONTENUE
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   82
     THIS SURROUTINE INTERPOLATES FOR ELVELINE AND GAM AT THE (1,1) GRID POINT FROM THE ARRAYS ELRE AND GAMME
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                   AMCEL
                                                                                                                                                                                                                                                              FIND GUADPILATERAL WHICH CONTAINS POINT
                                                                                                                                                                                    AMCEL
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   .
            LEVEL 2.NB, NBF, XBF, RBF, ELRF, GAMBC
                                                                                                                                                                                                                                                   34. TF (Y .GT. R9F(IST+1,JJ)) GO TO 586

IF (Y3F(IST+1,JJ) .LT. X5T(IST+1)) GO TO 520

$100E=(P8F(IST+1,JJ)-Y)/(X8F(IST+1,JJ)-Y)
           COMMON /8VAL/ NB, MBF(51), XBF(51, 100), RBF(51, 100), ELBF(51, 100),
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
               GA= RC (51, 107.)
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                    -VAL
            COMMON /SHOCKS/ DRSDX(1001,DST(50)
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                    SHOCKS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   99
          \(\text{Ref}\) \(\tex
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                    STOPAN
                                                                                                                                                                                    STREAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   91
                                                                                                                                                                                    POUNTS
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   93
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
           COMMON /FLOW/ XC(20.100), YC(20,130), VF(20,133), RHOF(26,100)
COMMON /DWSTRM/ ZPLOT, MZEND, NZADO, MXPLOT
                                                                                                                                                                                   FLIN
DNSTRA
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                               IF (SLOPEZ .LT. SLOPE) 69 TO 396
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   95
            THENSIAN TO(4), PO(4), ELO(4), GAMO(4)
                                                                                                                                                                                                                                                    350 CONTINUE
                                                                                                                                                                                                              13
14
15
                                                                                                                                                                                                                                                             ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANCEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                   98
           IF POINT IS ON SHOCK, USE FORMULAE AND SAVE RESULTS
                                                                                                                                                                                    ANFEL
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANCEI
                                                                                                                                                                                                               16
17
18
19
20
21
22
23
           IF (I .LT. NRMAX) GO TO 100
IF (J .GT. 1) GO TO 16
EL-EL-F(1,2)
                                                                                                                                                                                    ANCEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 100
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                111
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
            ANG-GAMRF(1,2)
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                                                                  PO(4)=RRF([ST+1,J]=1)
ELO(4)=ELAF(IST+1,J]=1)
GAMO(4)=GAMRE(IST+1,J]=1)
TF (JJ =EQ, M) CO TO 430
360 TF (IST =EQ, M) CO TO 370
TF (IST =EQ, M) ELT XST(IST-1,1)1 GO TO 56(
37) YO(31)=RRF(IST,J]=1)
RQ(31)=RRF(IST,J]=1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 103
   GO TO 40
10 THET=ATAN(DRSDX(J))
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 104
                                                                                                                                                                                    MITEL
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 195
            45=2 E46 THET 10+2
                                                                                                                                                                                    ANGE
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGFI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 106
           FM7=4MACHes?
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANCEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 107
            GAMZ = (GAMMA +1.0)+3.5+EMZ
                                                                                                                                                                                     ANGEL
           DDZ=1.0-(EMZ+52-1.0)+(GAMMA+EMZ+52+1.0)/(GAM2++2+52)
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                               26
27
                                                                                                                                                                                                                                                                                                                                                                                                                                        AUGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 100
                                                                                                                                                                                    ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                        ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 110
                                                                                                                                                                                                                                                              ELO(3)-ELRF([ST, JJ-1)
GAMO(3)-GAMBF([ST, JJ-1)
           COTH-1.0/ORSDY(J)
TO-GAMZ/(EM2+52-1.0)-1.0
                                                                                                                                                                                   AMGEL
                                                                                                                                                                                                               28
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                    383 YOLZ - YAFLIST, 331
           DELT-ATAMICOTH/TO)
                                                                                                                                                                                                               30
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                111
                                                                                                                                                                                                                                                              90(2) - 98F(15T-11)
           EL-SOPT(1.2 +COTH+COTH+(1.0+DD2)-2.0+DD+(TD+1.0)+COTH+STM(DELT))
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANFEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                114
                                                                                                                                                                                   ANGEL
                                                                                                                                                                                                               31
           ANG-THET-ASIN (DD-COTH-SIN(THET-DELT)/EL)
                                                                                                                                                                                                                                                               ELOC?1-ELBF(IST,JJ)
                                                                                                                                                                                   ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                               GAMG(2) - GAMBF(1ST, JJ)
                                                                                                                                                                                                                                                                                                                                                                                                                                       ANGEL
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 116
```

		ELLINF-JUAD (XO, PO, ELO, X, Y)	ANGEL	117
		GAMEL=GUAD(XG, RQ, GAMG, X, Y) RETURN	AMGEL	11.
				110
	107	CONTINUE	ANGEL	120
		TF (5179E2 .LT. 0.3) GO TO 350	AMGEL	121
		TF (YAF(1°T, JJ-1) .GT. X) GO TO 500	AMGEL	155
		11-11-1	WHEST	153
		TF (JJ .LF. 4) 60 TO 340	AMEEL	124
ŗ			ANGEL	125
ç		OUNCESTER SOUNDARY CUTS QUADRILATERAL CONTAINING POINT	AMBEL	126
r.			AMGEL	127
		IF (YAF(IST+1.JJ-1) .LT. XST(TST.1)) GO TO 46C	THEEF	126
		YO(4)-YAF(15T+1,JJ-1)	AMGEL	120
		PO(4)-RRF([ST+1,JJ-1)	AMEEL	130
		FLO(4)-ELPF(IST+1,4J-1)	ANGEL	131
		GAMO(4) - GAMME (TSTOL, JJ-1)	AMBFL	132
	41)	TF (15T .GT. HST) GO TO 470	AMEEL	133
		YO(11-Y4F([ST+1, JJ]	ANGEL	234
		*0(1)**RF([\$T*],JJ) F(0(1)*ELP*([\$T*],JJ)	AMREL	135
		Et 0(1)+ELPF(TST+1,JJ)	ANGEL	136
		FA = O(1) = GA = RF(15T+1.JJ)	WHEEL	137
	43.	[F [Y9F([ST,J]-]] aLTa **T([ST-1,]) RO TO 490	AMGEL	130
		Yn(31-YAF([ST-1]-1)	ANGEL	139
		PO(3)=P9F(TST, JJ-1)	ANGFL	140
		flo(3)=fl*f(157,JJ-1)	ANGEL	143
		GAMO(3)=GAMSF([ST,J]=2)	WALEF	142
	450	49=44F[[ST]+1	AMGEL	143
		YO(21-X4F(15T, NS)	ANGEL	244
		#O{*}=##F{{\$T.w\$}	ANGEL	145
		ELO(2)=ELRF(1ST,NS)	MACEL	146
		\$440(?)=G449F(?ST,4\$)	AMCEL	147
		ELLIMFOOUAD(YO, DO, ELO, X, Y)	ANGĒĹ	14*
		GAMEL # GUADE KO, RQ, GAMO, X, Y)	EMEST	149
		RETHRA	AMPEL	150
	460	x0(4)-44HK(1)	AMREL	151
		90(4) • Y SHE ())	ANGEL	152
		*L0141+EL	JENER	153
		GAMQ(4)=ANG	ANGEL	154
		GP T3 428	ANCEL	155
	473	YOUTS TOLOT	ANGEL	156
		CALL MSHK1(TO(1),RO(1),GAMO(1),ELO(1))	ANGEL	157
		GO TO 436	AMERE	154
	490	40(3)-457(T5T-1,1)	TALET	159
		TALL 454K3(X0(3), R0(3), GAMO(3), EL 0(3))	AMGEL	166
		67 17 450	MULL	161
c			ANGEL	162
Ĉ		DUADRILATERAL CONTAINING POINT IS PEFLEXING	MUEL	163
Ċ			AMREL	154
	942	11+11-1	ANCEL	165
		C[PF=(Y-RRF(ST,))-1) / (X-X4F(ST,))-1)	AMERL	166
		(GPE1(PAF(15T+1,4J-1)-RBF(15T,4J-1))	ANGEL	167
		 /(x4F(15T+1,JJ-1)-x4F(15T,JJ-1)) 	AMORE	160
		TE (SLIPE) ALTA SLIPE) ON TH SCC	ANGEL	169
		TF (SLIPE1 LTL SLIPE) ON TH SCC SLIPE2-(RRF(IST, JJ)-RBF(IST, JJ-1))/(YAF(IST, JJ)-XAF(IST, JJ-1))	ANGFL	170
		TE (SLIPE? .GT. SLIPE) OU TO SCL	ANGEL	171
		50 79 150	AMEEL	272
c			ANCEL	173
č		MOINT IS CLOSE TO SHOCK - NEED VALUES ON SHOCK	44651	174
č			AMPEL	175
-	. 22	10(1)=Y=F(757+], JJ)	ANCEL	176
	•	CALL SCHKICTOCITY COLLTAGAMORITY ELOCATE	ANCEL	177
		<pre><pre><pre></pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre></pre> <pre></pre> <pre><pre></pre><pre></pre><pre></pre><pre></pre><pre></pre><pre><!--</td--><td>ANGEL</td><td>178</td></pre></pre>	ANGEL	178
		<pre><!-- OPE2*(RO(1)-REFE[ST, JJ))/(YO(1)-YSF([<T, J1))</pre--></pre>	ANGEL	175
		TE (SIGNED ATTA SIGNE) OF TO 100	AMETL	195
	540	IF (SLOPEZ alt. SLOPE) AO TO 390 TO(4)-XCHY(J)	ANGEL	191
		00(4) = Y5HK(1)	MACEL	1 4 2
		EL9(4)=EL	ANGEL	1 4 3
		GAHQ(4) HAVG	AMESE	194
		40 TO 360	ANGEL	145
	560	V0(3)-Y5T(T5T-1,1)	ANGEL	196
		CALL ASHKI(10(3), RO(3), GAMO(3), ELO(3))	ANGEL	107
		40 TO 346	AMGEL	188
	5.40	41-47	VACEE	190
		CONTINUE	AMERL	100
c		• • • •	ANGEL	191
č		PROGRAM SHOULD NEVER REACH THIS CONDITION	ANGEL	192
č			AMESL	193
•		WPTTE(6,107C)	ANGEL	194
		STOP .	ANGEL	195
	1062	FORMATCIMI, 10x, 14HEPPOR IN ANGEL //5x,	ANGEL	196
		* 354PR7MANLE CAUSE - XPLOT IS TOO LARGE)	ANGEL	197
		END	ANGFL	199

. .

```
SUPPOUTINE SCORP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SCORP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  SCOMP
                                      THIS SURROUTINE CALCULATES THE COMPONENTS OF THE MAGNETIC FIELD
                                                                                                                                                                                                                                                                                                                                                                                                                                                               SC ONP
C
                                         PARALLEL, PERPENDICULAR AND MORMAL TO THE FLOW.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 BC DEP
                                      COMPON /BOUNDS/ X80D(100), Y803(100), X5HK(100), Y5HK(100),
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 BRIME
                                  COMPON /MOUNDS/ XMODIZOD, YMOZIZOD), XMX (103); YMX (13C); 

NMMAI, XMMAIXAMAU SAMENDHINCH; 

COMMON /FLOUR XCIZO:1001; YCIZO:1001; YFIZO:103); RMOFIZC, 1CC) 

LEVEL 2, PAPARA PEER, BROWN, PARAC; ARMO 

COMMON /ACOMPS/ PRABALIZO:1001; PEERF(2), 13G); PMORMIZO:1001; 

MANACIZO:1001; BANACIZO:1001; PEERF(2), 13G); PMORMIZO:1001; 

MANACIZO:1001; BANACIZO:1001; PEERF(2), 13G); PMORMIZO:1001; 

MANACIZO:1001; BANACIZO:1001
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  ROUNDS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 FL TV
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 79M03R
                                      TOTAL CONTINUATION AND THE CON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ---
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 PROPT
                                      COMMING JATH J AND PANGHAKECOMARCON(20)
OTHENSTON S(100,6), W(100), A(5), XLSO(150), YLSO(150)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RTH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    DATA W/100+1.6/
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  90 PMP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCOMP
                                     CALCULATE PEPPENDICULAR FIELD LINES
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 800MP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ACOMP
                                       TE (KACHH-EG-L -AND- -NOT-LARS -AND- -NOT-LTRAI) RETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 40.049
                                      CALL RELGAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 REGRE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 90046
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    21 22 23 24 25
                                      CALCULATE RIRTHE AND ELIFTIME AT EACH GRED POINT, THEN SHOOTH
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 -
                                       ALONG CONSTANT-E LINES, HISTNG FIFTH DODER LEAST SOHARES FIT
                                      40 Ha4044 Ya1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCOMP
                                       HAM ON ANT X-1
                                      UN ID SOITHANTAX
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCOMP
RCOMP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    26
27
29
30
31
                                      ASHGENERAL JISELENES COSTONO CONTRACTOR CONT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RC048
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 95048
85048
                                     00 10 1=2,484
4408#($,J)=#8[HF($,J)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ac gap
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ACDMP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    32
                                         CALL AMGELIELLINFASLOPELATAIN
                                     APERTET, JIECLEINE
AANGEL, JIECLEINE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCOMP
RCOMP
                   13 CONTINUE
9150111-0-0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 800MP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    36
37
39
40
41
                                     90046
                  5: CONTINUE +(XC(I+J+1)-XC(I+J))**2)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 #C04P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    42
43
44
45
                                         OO 45 JELONXMAX
                                  YESO(J)=RPERP[[,J)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCORP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  *COMP
                                      TALL ELEGEVENIMAN, 5, VLEQ, YLEG, V, 17, C, A, TFP1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 4C D4P
                                                                                                                                                                                                                                                                                                                                                                                                                                                               8004P
                                       ##E**([, ])-{(((#(6)******(5))*****(6))*****(3))*****(2))*****(1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 80040
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    49
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57
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ACTIMP
                                     CALCULATE COMPONENTS OF MAGNETIC FIGER - PARALLEL, PEPPENDICULAR, AND MORMAL TO DIRECTION FLOW
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCOMP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  9C04P
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 ACDAP
ACDAP
                                     00 73 J=1,874AT
*P&PA(1,3)*V=(1,3)*RH()=(1,3)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    57
                                       00 70 T=2,484AX
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RCCHP
RCCHP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    50
                                       unusa(1,13-mudem(1,13-mude(1,13
ubesb(1,13-mudew(1,13-mude(1,13
um voy(1,3)-mudew(1,13-mude(1,13-
um 1,13-mudew(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13-mude(1,13
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51
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                   73 CONTINUE
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 c
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 95 GHP
95 GHP
                                      PETHON
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    55
                                         FND
                                     CHRROUTINE SELGAM
LEVEL 2, NR, NSF, XRF, BRF, ELBF, GAMRE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 RELGAM
                                TOMMON /BVAL/ NA. MAFES11. YBFE51,1001. PRFE51.1001. ELAFE51,1001. CAMARES1,1001
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 AVAL
                                      COMMON JONSTRAJ ZPLOT-NZEND-NZADO-NZPLOT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 DUSTON
                                      COMMON TOTAL PROPERTY SECTIONS AND ARTER OF THE SECTION OF THE SEC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                  STREAM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 SHICKS
¢
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 9ELGA#
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ш						
ជ្	THIS SHEROUTINE CALCULATES THE MAGNITUDE AND DIRECTION OF	RELGAM	ė	JX5=X4c(3*1)-X8t(5*1)	BELGAM	93
4	C ELVELING AT THE POINTS WHERE THE STREAMLINES THTERSECT THE MACHETIC FIELD LINES WHICH ARE PERPENDICULAR TO THE FLOW	PELGAR	1¢	NR2=PAF(3,3)=BFF(2,3) N2=SQRT(NX2+NX2+DR2+DB2)	RELGAM	94
	C IN COLESTAGN	MELGAM	12	GAMZ=ATAN(DR2/912)	MELGAM RELGAM	96
	PST(1)+C-5/YST(1+1)	951644 951644	13	ELRF(2,J)=(ELRF(2,J-1)+01+D5T(2))+D2/(D1+D2) GAMRF(2,J)=(D1+GAM2+D2+GAM8F(2,J-1))/(D1+D2)	RELGAM RELGAM	97 98
	00 17 T-2.4ST 0ST(1)-1-0/(YST(1-1)-YST(1-1-1))	RELGAM	15	163 CONTINUE 00 170 1-3, NST	PELGAM	90
	1) CUNTINUE	9 EL GA 4 R EL GA #	16 17	TF (MMFfI+1) .LT. j) GO TO 18j	RELGAM RELGAM	100 101
	C LEL TODALL LO ESÉÉ ZISÈTH ATTALL	MELGAN Melgan	10	01=02 GAM1=GAM2	9ELGA4	192
	C N5T03+N5T+1	BELGAR	20	7×2=×9F(I+1,J)-×8F(I,J)	RELGAM	103
	MEMAY=4PF(1)	BELGAM Melgam	?1 ?2	^RZ=RAF(I+1,J)=RAF(I,J) ^Z=SOBT(^X2+)XZ+^RZ+\RZ+\RZ)	RELGAM	105
	nn an t-1.4stel Te (Nae(t) .lt. Jae4xx) en to 20	RELGAM BELGAM	23	<pre>CLAF(I, J)=D1+D2/(D1+D2)+(DST(I-1)+DST(I)) GAM2-ATAM(DR2/DX2)</pre>	SELGAN	107
	JAEMAYe NAE (T)	BELGAM	24 25	SAMSE({,J}=(GAM1+92+GAM2+D1)/(D1+D2)	RELGAR RELGAR	10*
	JU S: 103*14cHTA 30 LUALIANE	RELGAM RELGAM	26 27	17) CONTINUE	RELGAM BELGAM	111
	70 2	RELGAM	2.0	Ell=010000T(T=2) Fl2=0200TF(T=1)	RELGAM	117
	CAMBETT. JIMPICH2	RELGAM RELGAM	3t Ša	91=01+2+0+92	MELGAM BELGAM	113 114
	S. CUMTIMIE	PELGA4 PELGA4	31 32	n2=-n2 EL9F(T, 1)=(EL1+n2+EL2+n1)/(n1+n2)	RELGAM	115
	C NATION STONG ELETO FINES ANICH COURS SHOCK	RELGAM	33	GAMBE(T. 1)#1GAM1#924GAM2#D1\//D14D2\	MELGAM MELGAM	116 117
	0 130 J=3, N3	BELGAM Melgam	34 35	TE (CAMBE(T, J) aLTa Sau) CAMBE(T, J)=>a/s	RELGAM	118
	⁷	PELGAN	36	C SYTEMPOLATE ALONG CERCANIANA	RELGAT	120
	01-<0#T({Y45(2,J)-X#F(1,J))++2+#45(2,J)++23+2,4 F(#F(2,1)+01+D5T(1)	BELGAM BELGAM	?7 3•	C EXTRAPOLATE ALONG STREAMLINES TO LAST GRID LINE	RELGAM RELGAM	121
	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	AELGA *	39	CALL SCHRITZPLOT, Y1, GAM1, EL1) DD ZCC Y-3, MSTP1	RELGAM	123
	NP2+P4E(3,J}+p4E(2,J)	MELGAM MELGAM	40 41	**************************************	RELGAM	124
	``````````````````````````````````````	BELGAM Belgam	4? 43	MIMPHMIMST([=1] TF (YAF([],M=1) aLTa XST([=1,1]) GO TO 22:	PELGAM MELGAM	176
	FLRF(2, J)=01=02/(01+02)=(05T(2)+05T(1))	RELGAM	44	FAC=(7PLNT-XAF(T,M-1))/(YBF(T,M)-XBF(T,M-1)) YAF(T,M+1)-YST(T-1,MUMM)	RELGAM	127
	GAMPF(2,J)+(GAM1+92+GAM2+D1)/(D1+D2)	#5644 #5644	45	PAF(T,N+1)=YST(I=1,NUMM)	RELGAM RELGAM	129
	1/3 CONTINUE	RELGAM	47	FLBFFT.Well=FaceEleFitsNb+(loC=Facbelanc(t,v=1) Camer(t,v=1) FACeGAMEF(t,Nb+(loC=Facbelanac(t,v=1) TC	RELGAM	131
	71-50974(x4F{2,J]-x8F{2,J-1})***2+{pg<{2,J}-eec{2,J-1}}***2********************************	95LSA4	40	TE (CAMPE(I, No.1) aLT. 0.0) GAMPE(I, No.1) =0.0	BELGAM BELGAM	132
	n2=5n4T{nx2+nx2+nx2+nx2+nx2}	RELGA4	9.5 8.1	Ti+T	BELGAM MELGAM	134
	FAM2=ATAN(DR2/DX2)	SELGA-	51 52	07 TO 246 22) PRF81.443)=YST4[-1,4UM4)	RELGAN	13° 136
	F1 = F(2, 1) = (EL MF(2, 1 = 1) + O1 + O5 T(2) 1 + O2 Y(D1 + O2) CAMAF(2, 1) = (D1 + GAM2 + D2 + GAMAF(2, 1 = 1) ) / (D1 + O2)	RELGA#	53 54	YAFET-Not to YCTET-), MIMMA	RELGAM BELGAM	137
	160 CUALIMIE	RELGAM	55	FAC=(Y1=PRF(T,H+1))/(Y1=RRF(T1,H1+1)) FL=F(T+H+1)=ELRF(T1,H1+1)+FAC+(T+U-FAC)+FL1	BEEUVA	139
	∩1 = DZ	#FLG##	56 57		RELGAM	14C 141
	<pre>cam1=gam2 tf (vaf(1+1+1+)) +LT+ yst(1+1+) +O TO 120</pre>	BELGA4	5 9 5 9	TE CONTINUE -LT. Jan) GAMPE[[AN-1]=3.0	RELGAN	142
	Nx2=Y9F(1+1,4)=Y8F(1,4) NP2=P8F(1+1,4)=P8F(1,4)	RELGAR	40	የናቸ()0 \ E ክን	BELGAM	143
	72=434T(D#2+D#2+D#2+D#2)	RELGAN	61 62		RELGAM	145
	FL	SEL GAS	63			
	GAMAFET.J10 (GAM1 0D2+GAM2+D1)/(D1+D2)	RELGAN	6.4 5.5			
	11% CONTINUS 120 YSH=YSFCI=1,43	MELSAM MELSAM	6 ¢	CONTINE WILLIAMS	BOUND	?
	CALE ACHRIERCH, RSH, CAMSH, ELCH) DYZ-YSH-YAFET, JI	RELGA-	54	C THIS ROUTINE DRAWS AND LARELS SHICK WAVE AND	POUNT	4
	992-9934-par (T-J)	RELGAN	50 75	C MACHTACAPHERE OR INMOVEMERE BOUNDARY. C UCC PLOT SURTIUCERUS USED ARE	BUTHU BUTHU	5
	12+5087(0X2+1X2+1X2+DR2)+Z,0 ELRF(T+J)+N1+(DST(T-1)+N2+ELS4)/(D1+N2)	RELGAM RELGAM	71	C VECTOP, CHAR, POLAP.	ROUND	7
	GAM46(1'9)=(U546441+U5464241)(U5+U5)	PELGAN	72 73	COMMON /800HOS/ X800610C3, Y800(1003, YSHK61C3), YSHK61061,	#11140 #11140	2
	TabmaAeMab(3)	RELGAM RELGAM	74 75	· NEWAY, NEWAY, AMACH, GAMMA, HPO, NMENDE COMMON ISCALEY ISE, ISE, IMAX, IMAX, INGTH, INGTH	SCALE	3
	C VALUES ALDME FIELD LINES WHICH END AT DOWNSTREAM ADUNDARY	RELGAN	76	OTMENSION P(21).A(21) OTMENSION LASMG42)	<b>57UN</b> 9	11
	· C	RELSAN	77 78	PATA LARMGE11,LARMGE21,LARIO/ICHMAGNETOPAU,245F,GHIGHOPAUSF/	4 <b>1 UN 1</b> <b>4 1 UN 1</b>	12
	JO 10° Todaj*10kdVA	9ELGA4 RELGA4	79 36	NATA LARSH/10HSHNCK WAVE/ NATA 4/00001570800314160047124006283200785470	#9999 4989	14 15
	15 (J .ST. MAF(1)) GO TO 152	RELGAR	41	1 94244,1.09956,1.25664,1.41372,1.57096,	801110	16
	n1-5ne1(   xaf(2, 1)-xaf(1, 1)  2-pac(2, 1)21-2, ] c[ac(1, 1)-2]-xaf(1)	RELGAM Relgam	92	? 1.72788,1.88496,2.54204,2.19911,2.35519, 3 2.51327,2.67035,2.82743,2.98451,3.14159,	87UN7 90UND	17
	~x2•x4E(3•1)-x8E(2•1)	<b>MELGAM</b>	84	DATA 9/21/031/	AGUND	19
	NR2=P4F(3, 1)=P4F(2, 1)	RELGAM BELGAM	45 96	c	9 11 13 N N 9 11 13 N N	2^ 21
·	02=50PT(DX2+DX2+DR2+DR2) Gam2=atan(092/DX2)	MELGAM Melgam	47 36	C DRAW AND LAREL BODY BOUNDARY.	A TUNT BOUND	?1 ?? ?3
	ELMF(2,J)=01=02/(01+02)=(05T(2)+05T(1))	RELGAN	59	CALL VECTOR (XROD, YROD, NXMAX, 1, 0, 1H 1	BOIMS	24
	SAMPE(2, J)=(GAM1=02+CAM2=01)/(01+02) SO TO 160	RELGAM	9¢ 91	XLARL==1+0+1+0/FSF YLARL=3+6	87U4D 87U87	25 26
	15. n1-5087((18F(2,1)-18F(2,1-1))**2+(88F(2,1)-RRF(2,1-1))**2)*2.0	RELGAN	92	TF (NHINDY .EQ.1) GO TO 5	=กบุพก	27

	CALL CHARCELAGE, VLAGE, Jody ol 2, LARMS , 121	BOUND	28	TF (N4TNDX .EQ. 1) GO TO 13	ROUT	4.9
e	GD TO 16	500MD 600M0	29	WR?TE(6,135) JZ,7 GO TO 15	ROUT	50 51
ř	TONOPHUSE - ADD HPO TO LAREL	80UND	3¢ 31	13 WP [TE (6,135) J2, Z	อายา	52
r	2 Part Pulpersant Widow A . 12	AGUND	32	15 [-1	ROUT	59 54 55
	5 CALL CMAPERLAGL, YLAGL, 0.0, 12, LASTO, 91 YCH=-1.5+3.4/YSF	90 9N 0 90 UND	33 34	WO TTE (6, 12).1 I, YC(I, J), BPARA(I, J) OO 20 T-2, NRMAX	47UT	55
	YCH=Y#4Y-J. 3/YSF	BOTHD	35	(L, T) 4 P3 4 P4 Q P4 7 P4	9.7117	76
	CALL CHAR(XCH, YCH, D.C, 2, 3HH/R, 3)	POUND	36	92=CAMGP+RPAPA(1, 1) F1=COS(ANG(1, 1))+82+COS(PAMG(1, 1))+91	AGUT AGUT	57 58
	CALL CHARTXCH++6/XSF+YCH+0+0+07+140+11 CALL CHARTXCH++75/XSF+YCH+0+0+0+0+0+11	ลฤษเก ลฤษเก	37 34	F2-STN(ANG( [_J]) 1-32-03( "ANG( [_J]) 1-31	AGUT	59
	CALL MUMPLT (XCM+1./YSF, YCH+6.3, .2, MM7.2)	BOIND	30	4MAG(1,J)=SORT(F1+F1+F2+F2)	BOUT	66
Ç		UNDUE	40	BANGP-ATANZ (FZ, FI) O NEG My o Fi o Cangn	90UT 90UT	6 <u>9</u>
ç	MAN AND LAREL SHOCK WAVE.	29(19) 29(19)	41 42	TYEZ PÉANGN	AGUT	59
	1) CONTINUE	*7949	43	#7egund#{I,J}+SANGN	90117	64
	CALL VECTOR EXSHK, YSHK, MYHAY, 1, C, LH 1	8 3 5 6 9 5	44	WRITE (6,120) I,YC(I,J), MPARA(I,J), BPERP(T,J), RMAG(I,J), RAMSP, MRORM(I,J), BX, BY, RZ	AGUT	65
	Y(	97549 97649	45	2) CONTINUE	*011T	66 67
	CALL CHAPEXLABL, YLARL, U.J: 2. LARSH, 101	ROUND	47	PETION	ROUT	6.0
C		RUINA	4.9	C 160 FORMATCIMI//52%,254MAGNETIC FREED COMPONENTS/52%,25(14+1/)	AGUT AGUT	49 70
ç	UDAN THU TTREE BETWEE EUG HTCHELDZBARBE	ROUND	4 Q 5 G	113 FORMATY//21H ANGULAP LOCATION NO., T2, 124, AT THETA #, FF.44,	8007	71
•	TF CHITNDY .EQ. 15 RETURN	971110	51	* 94 DEGREES//	9701	72
	PHAY-1042F	ROUND	52	<ul> <li>4*,14*1,5**,44*P*10,6**,2(64*P*16**)*,64*9,91**,5**,74**,14**,5**,74**,74**,74**,74**,74**,9**,74**,9**,74**,9**,74**,9**,9**,9**,9**,9**,9**,9**,9**,9**,</li></ul>	ROUT ROUT	73 74
	Pall Phlager, a, NP910C91H ,-RHEY91.1 Call Chares, CB9300, C12, 6HPLAMET, 61	RGUNG RGUNG	53 54	* 214.10H(PAPALLEL).4X,6H(PEPP),4X,2(10H(TN-PIAHE),2X),1X,	8/3/17	75
•	CHEC CHANGE TO BOOK DE CONTRACTOR OF THE CONTRAC	97047	55	# #HENDRHAL Falka SCIKA IIHCRESULTANTATA	97UT	76
	ocillon	901140	4.6	115 FORMATI//214 ANGULAR LOCATION NO., 12, 124, AT THETA ., FR.A.,  • 94 DECREES//	ROUT	77 70
	.twÙ	# TUND	57	• 44.141.6x.5449/R3,7x,2164R/RINF,6x1,648/RINF,5x,7H9=4NGLE,5x,	9017	79
				<ul> <li>7M 7/11/NF,5%,7H%%/BINF,5%,748Y/MINF,5%,7447/MINF/</li> </ul>	ROUT	9.2
				<ul> <li>21% 30H(PARALLEL) y 4% y 64(PERP) y 4% y 2(1('46(N+PLANE) y 2%) y 1% y</li> <li>PH(NOPMAL ) y 1% y 3(1% y 11H(RESHLTANT) )</li> </ul>	ngur ngur	91 92
	SUBSTITUTE BOUT	ROUT	,	12.4 FR9 MAT(15, 912 X, F11, 41)	9707	43
ç	THIS SURROUTINE PRINTS OUT THE HAGNETIC FIRED	RGUT	3	133 FORMATE//334 ADDITTONAL AFFAL LOCATION NOT2,154, AT FED =,F*.4//	AGUT	94
ř		90UT	:	<ul> <li>4*,147,7%,348/0,8%,2(648/8[4F,6%),64%/9[4F,6%,749-44GLE,5%,</li> <li>74</li></ul>	AGUT AGUT	45
	COMMON /AIN/ AMGP, ANGN, KACON, ACON(2.)	PŢN	ż	* 21x+13HCP ARALLELD, 4x, EMCPEROD, 4x, 203 HC (N+PLAMED, ZXD, LY,	Anut	47
	COMMON JONSTRM/ TRLOT, NTEND, NTADO, NXPLOT Level 2, ang, rith, dec	D& D D# < 1 & 4	2	+ SHENDEMAL 3, 1x, 3f1x, 11HEPESUL TANTS FS	3707	9.0
	198999 /PRO/ ANGE23.12.14PXTHE1	DEL	<b>'</b>	135 FORMATCI//304 ADMITTIONAL ARTAL LOCATION NO., 12,114, AT Y/SC *,F8.4/ * 47,141,77,448/80,78,21648/914F,681,648/914F,58,748-A4GLF,58,	AUIIT AUUT	90
	LEVEL ?p APAGA.APFRP,BMORM,MAG,RANG	ALD462	2	• 74 9/9/45,5%,749%/AINF,5%,749%/AINF,5%,7497/AINF/	AGUT	91
	COMMON /ACCHPS/ APARA(25,100),895RP(20,10,1,4MORM(20,100)), - MMAG(20,100),MANG(20,100)	BCUMBS	3	<ul> <li>?1Y+10HfP4R4LtEt3y4Xy6HfPEPP)y4Xy2f1SHfTN-PL#NF3y2X1y1Xy</li> </ul>	ROUT	92
	COMMON /REUNT/ THETA(25),00(20,25),49EHNT	PLUNT	,	• #4(HOPMAL), 1x, 3(1x, 114(PESIJL*A4T))) FNO	ROUT	94
	COMMON /ACCURACY *ACCIOSI-YECOLOGI-YECKLICSI-YEKKI3AKI-	#31JM95	ž		- 117	7-
	<ul> <li>HPMAY, MXMAX, AMACH, GAMHA, MRD, NATHOX</li> <li>MMMON /FLOW/ XC(25,103), YC(23,17(3,VF(20,1303, RMDF(27,163)</li> </ul>	FLOV FLOV	3			
r	24-04 1-0001 (0.53)10011 (0.53)11(1.134-1.5.)11.13 Kmild (5. ) 16.3	#[174 #[175]	13			
	ZENCD-SIN(FHCD)	ROUT	14			
	CANCS=SIN(ANGN)	ACUT ACUT	15	CUPROUTTHE MSHK1 (X)R)ANG,ELS	BCHLJ BCHLJ	Ş
	CANCH-COS(ANGH)	93UT	16 17	C THIS SUPPOSITINE CALCULATES THE MAGNITUDE AND DIRECTION OF	#4nk1	4
_	notic(v)[37]	*9117	1.	C ELIELING AT THE SHOCK, AND THE R-LOCATION. GIVEN THE	a 5 MC 1	•
Ċ	PRINT MACHETTE FIFER FOR WICE DIGITAL	RGUT	10	C A-FOURTION DE THE BUINE	45461	é
Č	BEING ATCHELLU EIFIN EUB KÜZE BEGINA	AGUT AGUT AGUT	ž¢.	C A-FOURTHANDS ABOUTION PAGGETOR PARAGEOUS ARACTOUS ARACTOUS C A-FOURTHAND OF THE BOLDEL	454K1 454K1 491HP5	
	99 10 J+1+4=LUNT	AGUT AGUT AGUT	20 21 22	C - Linearing the paint C - Newyork Janus Xannilus, yannilus, xane(100), yanax, xanaxan, xanaxan, nutung	44441 4441 44441 44444 4444	6 7 2 3
	77 10 J+1,44(UNT ) *F (44(40x .E0. 1) GO TA 3	ggiệt ROUT ROUT ROUT	20 71 72 23	C X-LOCATION OF THE POINT OF TH	REHKI REHKI ROUNDS ROUNDS SHOCKS	6 7 2 3 2
	99 10 J+1+4=LUNT	AGUT AGUT AGUT	20 21 22 23 24	C Y-LOCATION OF THE POINT  C C COMMON JAMINDS/ X80081UC1, Y80081UC1, XSHK(1001, Y5HK(1001, Y6HO))  NHAMY, NAMAWY, ARABE, GANHA, JAMIN, MHI NOT  ONMON JSHO(XS) DRSDX(1/0)1, DST(65)  ON TO J=1, NAMAWAY  IF (Y LITA XSHK(1)1) ON TO 26	44441 4441 44441 44444 4444	6 7 2 3
	00 10 J=1,4=LUNT "F (44140x .60. 1) GD TO 3 W0TT(6.11) J.THETA(J) CD TO 9 3 W0TTT(6.115) J.THETA(J)	ggirt Anut Agut Agut Agut Agut Agut Agut	20 21 22 24 25 26	C T-LOCATION OF THE POINT  C COMMON JAMINDS/ XBOOKIUL), YBOOKIUL), YBOWKIUNDS  MANAY, NUTHAY, ANGLOG CAMHA, HBO, NHI NDS  ON HOMEN JSHOCKS/ DRSNK(1/12), PST(5C)  ON LO J-LAWHAK  TE (V .LT. XSMK(1)) ON TO 2G  1) ONITHINE	REMET REMET ROUNDS SHIPERS REMET REMET REMET	6 7 2 3 2 1 11 11
	00 10 1-1-M=LIMT *F (MMIMDX .60. 1) GO TO 3 MOTTE(+.11)	SOUT SOUT SOUT SOUT SOUT SOUT SOUT SOUT	20 21 22 23 24 25 27	J-MYMAY  C  T-LOCATION OF THE POINT  C  TO 10 J-LIVATAN  TE (Y _LIVATAN  TE (Y	REMEI REMEI ROUNDE ROUNDE SHOCKE REMEI REMEI REMEI	6 7 2 1 1 11 12 13
	00 10 1-1-M=LIMT 'F (MMIMOX .E0. 1) GO TO 3 WOTTE(4.11)	ggirt Anut Agut Agut Agut Agut Agut Agut	20 71 72 23 24 25 26 27 28	C T-LOCATION OF THE POINT  C COMMON JAMINDS/ XBOOKIUL), YBOOKIUL), YBOWKIUNDS  MANAY, NUTHAY, ANGLOG CAMHA, HBO, NHI NDS  ON HOMEN JSHOCKS/ DRSNK(1/12), PST(5C)  ON LO J-LAWHAK  TE (V .LT. XSMK(1)) ON TO 2G  1) ONITHINE	REMET REMET ROUNDS SHIPERS REMET REMET REMET	6 7 2 1 1 11 12 13
	nn 10 J=1, NBLINT "F (MMINDX .EO. 1) GO TO 3  volve(e,11): J, TMETA(J) co to 5 3 volve(e,115: J, TMETA(J) 5 "=1  volve(12.) T, PPP((,J), APARA(I,J) no 1/ T=2, NBRAX 3=15ARGOOPSPO(I,J)	9707 9707 9707 9707 9707 9707 9707 9707 9707	20 71 72 23 24 25 26 27 28 29	C	REMEI REMEI ROUMES ROUMES REMEI REMEI REMEI REMEI REMEI REMEI REMEI REMEI	672 32 11 12 13 14 15 16
	nn 10 Jelematint 'F (MMIMOX = 60 - 1) GD TO 3 wolve(e,11) J.TMETA(J) CO TO : STOT(6,115) J.TMETA(J) 'Tal woltf(6,115) J.TMETA(J) To 10 TO : Woltf(6,115) J.TMETA(J) To 10 TO : STOT(6,115) T.TMETA(J) TO : STOT(6,115) T.TMETA(J	9707 ROUT ROUT ROUT ROUT ROUT ROUT ROUT ROUT	2c 71 72 23 74 25 26 27 28 29 30 31	C Y-LOCATION OF THE POINT  C C C C C C C C C C C C C C C C C C C	RSHKI RDINNS SHICKS RSHKI RSHKI RSHKI RSHKI RSHKI RSHKI RSHKI RSHKI RSHKI RSHKI	67232 111213 145145 147
	nn 10 J=1, N=LINT 'F (MMIMDX oF0= 1) GD TD 3  WOTYC(6+11) J=TMETA(J) 'CD TO 6  3 WETTC(6+12) J=TMETA(J)  5 ***  WOTTC(6+12) T=PP(T=J) ***  N=17 (5+12*) T=PP(T=J) ***  N=15 ANCOOPEEPT[T=J]  %=COS(ANC(T,J)) ***  %=COS(ANC(T,J)) ***  %=COS(ANC(T,J)) ***  %=SENTANCOOPEEPT[T=J]  %=COS(ANC(T,J)) ***  %=SENTANCOOPEEPT[T=J]  %=	9707 9707 9707 9707 9707 9707 9707 9707 9707	20 71 72 23 24 25 26 27 28 29	C T-LOCATION OF THE POINT  C TOWNIN JAMINDS/ MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT	REWELL REMELL	67232 1123 1123 1123 1123 1134 1139
	00 10 J=10M=[UNT 'F (MM[MDX JEO, 1) GO TO 3 MOTT((+,11)) JJTM=TA(J) ON TO 3 WOTT((+,11)) JJTM=TA(J) '**  MOTT((+,12) TJM=TA(J) '**  MOTT((+,12) TJM=TA(J) TO 1	9 7 10 T 9 7 10 T	2	C T-LOCATION OF THE POINT  C COMMON JAMINDS, XBONGLUL, JYBONGLUL, JXSHK(100), YSHK(100),  • NAMAY, NYMAY, ANGLOH, GAMHA, JHON, NHINDY  ON HOLL AND HAS  TO LO J-LANMAN  TO LO J-LANMAN  TO LO J-LANMAN  20. PAYSHK(J); ON TO 26  21. PAYSHK(J); ON TO 26  22. PAYSHK(J); ON TO 26  THETI-BTANCORSOX(J-1)  THETZ-BTANCORSOX(J-1)  THETZ-BTANCORSOX(J);  THETTHETI-(X-XSHK(J-1))*(THETZ-THETI)/(XSHK(J)-XSHK(J-1))  C C CALCULATE MAGNETURE OF VERTICAL FIELD COMPONENT OF SHOCK	REMEI	67232511234567896
	nn 10 J=1, N=LINT 'F (MHIMDX of 0. 1) GD TO 3  WOTY*(6+11) J_THETA(J)  TO TO 5  WOTTP(5+12.) J_PHETA(J)  TO T	anit anut anut anut anut anut anut anut anu	20173456722973345	C T-LOCATION OF THE POINT  C TOWNIN JAMINDS/ MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT/MAGNICLULT	REMEI	67232012345678901 1111111122 1222
	nn 10 Jelnmelint 'F (MMIMDX of 0. 1) GD TO 3  WOTY*(6+11) JoTMETA(J)  SO TO 5  WOTY*(6+12) JoTMETA(J)  SO 1  WOTX*(6+12) JoTMETA(J)  TO 15 TO 1  WOTX*(6+12) JoTMETA(J)  TO 15 TO 2 MMIMD 1  MODEL TO 15 TO 2 MMIMD 1  TO 3 MMIMD 1  TO 4 MMIMD 1  TO 5 MMIMD	9 7 10 T 9 7 10 T	20 7 ? 2 3 4 5 5 6 2 7 8 9 7 2 3 4 5 5 6 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	C	REMITED REMITE	6723211234567890123
	nn 10 Jelematint 'F (MMIMDX #60. 1) GO TO 3  WOITE(#.11)1 JATMETA(J) 'ON TO 3  WOITE(#.115) JATMETA(J) 'al  WOITE(#.12.) [**PF[*.J]***PAPA([*.J) 'nn 1'. Telemax 'alsanceerpet[*,J) 'al-congenerat(*,J) 'el-congenerat(*,J) 'el-congenerat(J) 'el-	quir quur quur quur quir quir quir quir	20173450722373345078	C T-LOCATION OF THE POINT  C C C C C C C C C C C C C C C C C C C	45-461 45-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461 46-461	67232c12345678961234
	ng 10 Jelemetint 'F (MMIMDX eCo. 1) GD TO 3  wotye(e,113) Jetheta(j)  co to 5  a wotye(e,113) Jetheta(j)  co to 5  a wotye(e,113) Jetheta(j)  co to 5  a wotye(e,113) Jetheta(j)  co to 7  wotye(e,113) Jetheta(j)  co to 7  a control of the first of the f	qqirt qqut qqut qqut qqut qqut qqut qqut qq	277235567891123456789	C	45-461 ACHINO C SOUTH OF S S S S S S S S S S S S S S S S S S S	67232456789612345
c	nn 10 Jelematint 'F (MMIMDX #60. 1) GO TO 3  WOITE(#.11)1 JATMETA(J) 'ON TO 3  WOITE(#.115) JATMETA(J) 'al  WOITE(#.12.) [**PF[*.J]***PAPA([*.J) 'nn 1'. Telemax 'alsanceerpet[*,J) 'al-congenerat(*,J) 'el-congenerat(*,J) 'el-congenerat(J) 'el-	quir quur quur quur quir quir quir quir	201234567222173334557490	C	45-WLI 47-WLI 47-WLI 47-WLI 47-WLI 47-WLI 45-WLI 45	67232c1234567890123456
c	ng 10 Jelenelint  r (MMIMOX «Co. 1) GO TO 3  wotre(e,11) J.TMETA(J)  co to ;  suptr(e,11) J.TMETA(J)  r (MMITT (e,11) J.TMETA(J)  r (MMITT (e,12) J.TMETA(J)  r (e,	qqirt qqurt	20172345672456722237333455789012	C	# \$ WE   # \$	672321123456789612345678
c	nn 10 Jelemetint 'F (MMIMOX #60, 1) GO TO 3  WOTTC(6,113) J.TMETA(J) GO TO 5  S WOTTC(6,115) J.TMETA(J) 'Tol  WOTTC(6,115) J.TMETA(J) 'Tol  WOTTC(6,115) J.TMETA(J)  Tolorical Colorical  ### Tolorical Colorical  ###################################	quirt adurt	27723456789 C123456789 C12345678 C123456778 C123456778 C123456778 C123456778 C123456778 C123456778 C123456778 C123456778 C123456778 C123	C	45-WLI 47-WLI 47-WLI 47-WLI 47-WLI 47-WLI 45-WLI 45	672321123456789612345678
c	ng 10 J=1, NBLUNT 'F (MMINDX = CO. 1) GD TO 3  volve(s,11) J=TMETA(J)  co to 5  3 volve(s,115) J=TMETA(J)  to to 5  volve(s,115) J=TMETA(J)  to 15 T=2, NBMAX  no 15 T=2, NBMAX  nlsa Nacesseper(I,J)  n2=CAMCO = nAce(I,J)) = n2 = COS(RANG(I,J)) = n2  to 2 = CAMCO = nAce(I,J)) = n2 = COS(RANG(I,J)) = n2  to 2 = SMCALANCI (J)) = n2 = COS(RANG(I,J)) = n2  to 3 = n2  to 4 = n2  to 3 = n2  to 4 = n2  to 3 = n2  to 4 = n2  to 5 = n2  to 6 = n2  to 7 = n2	qqirt qqurt	20172345672456722237333455789012	C T-LOCATION OF THE POINT  C C COMMON /ROUNDS/ X900(13U-), Y900(13U-), X544(100), Y544(100), W1444, NAMAY, AMACH, CAMHA, HEO, NHINDY ON HOME /SHOCKS/ DRSDX(*/O), DST(50) ON 10 J-1.N4MAY IF (Y LIT. KSMK(J)) OO TO 20  13 CONTINUE  J-MYMAY  2: POYTHE(J=1)-(IX-X5MK(J-1)) O(Y5MK(J)-Y5MK(J-1))/(Y5MK(J)-Y5MK(J)-Y5MK(J-1)) THETO-ATAM(DRSDX(J-1)) THETO-ATAM(DRSDX(J-1)) THETO-ATAM(DRSDX(J-1)) C C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT OF SHOCK  C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT OF SHOCK  C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT OF SHOCK  C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT  C C CARCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT  C C CALCULLATE ANGLE OF VERTICAL FIELD COMPONIENT  C C CALCULLATE ANGLE OF VERTICAL FIELD COMPONIENT	REMEI ROTHING	67237 112345 67890 1234 5678 961
c	nn 10 Jelnatunt 'F (MMINDX GEO. 1) GO TO 3 WOTTE(6,11) JJTHETA(J) 'CO TO 5 3 WEITE(6,115) JJTHETA(J) 'CO TO 5 3 WEITE(6,12) JJTHETA(J) 'CO TO 5 4 WEITE(5,12) JJPHETA(J) 'CO TO 6 10 WEITE(5,12) JJPHETA(J) 'CO TO 7 10 TE2,MRMAY 'N 15 TANCOOPERPT(J,J) 'CO TO	agirt	27723456788712334557890124456	C T-LOCATION OF THE POINT  C C C C C C C C C C C C C C C C C C C	= q-wil	6723241211122222222222313
c	ng 10 J=1, NBLUNT 'F (MMINDX = CO. 1) GD TO 3  volve(s,11) J=TMETA(J)  co to 5  3 volve(s,115) J=TMETA(J)  to to 5  volve(s,115) J=TMETA(J)  to 15 T=2, NBMAX  no 15 T=2, NBMAX  nlsa Nacesseper(I,J)  n2=CAMCO = nAce(I,J)) = n2 = COS(RANG(I,J)) = n2  to 2 = CAMCO = nAce(I,J)) = n2 = COS(RANG(I,J)) = n2  to 2 = SMCALANCI (J)) = n2 = COS(RANG(I,J)) = n2  to 3 = n2  to 4 = n2  to 3 = n2  to 4 = n2  to 3 = n2  to 4 = n2  to 5 = n2  to 6 = n2  to 7 = n2	agirt agurt	27772756789 C 1 2 3 4 5 5 7 8 9 6 1 2 3 4 5 5 7 8 9 6 1 2 3 4 5 5 7 8 9 6 1 2 3 4 5 5 7 8 9 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	C T-LOCATION OF THE POINT  C C COMMON /ROUNDS/ X900(13U-), Y900(13U-), X544(100), Y544(100), W1444, NAMAY, AMACH, CAMHA, HEO, NHINDY ON HOME /SHOCKS/ DRSDX(*/O), DST(50) ON 10 J-1.N4MAY IF (Y LIT. KSMK(J)) OO TO 20  13 CONTINUE  J-MYMAY  2: POYTHE(J=1)-(IX-X5MK(J-1)) O(Y5MK(J)-Y5MK(J-1))/(Y5MK(J)-Y5MK(J)-Y5MK(J-1)) THETO-ATAM(DRSDX(J-1)) THETO-ATAM(DRSDX(J-1)) THETO-ATAM(DRSDX(J-1)) C C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT OF SHOCK  C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT OF SHOCK  C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT OF SHOCK  C CALCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT  C C CARCULLATE MAGNETUDE OF VERTICAL FIELD COMPONIENT  C C CALCULLATE ANGLE OF VERTICAL FIELD COMPONIENT  C C CALCULLATE ANGLE OF VERTICAL FIELD COMPONIENT	REMEI ROTHING	67237 112345 67890 1234 5678 961

	PETURN	95 HK1	35	<b>An Bio</b> A a ma		
	ENU	45HK1	36	NO 719 1+3+N8 IF (MAFCI-J-1)+DSINF .GT. XSTCTM-1)) GO TO 72C	BSTEP	76
				X8E(1,1)=X9E(1,1=1)=DSINE	957EP 957E#	77 78
				PRF(I,J)=YST(IM,1)	94 TEP	79
				713 CONTINUE	PS TEP PS TEP	91
•	CHAPOUTENE ASTER	RSTEP	2	C LOCATE POINTS WITHIN THE MAGNETO/ION*PHERE	45 T C P	*1 12
č	THIS SUPROUTING CALCULATES THE VERTICAL FIELD LINES,	997EP	3	c ·	AS TEP	éş
•	TO INTERNITING ALONG SACH STREAMLINE TO LOCATE POSITIONS	45759	3	723	ASTER	94
ć C	AT EQUIAL TIME INTERVALS	ASTEP	6	421=1	ASTEP ASTEP	45
٠.	COMMON FREUNTF THETA(251) PP(23) 251, NOLINT	AS TED ALCINT	7 2	tf (I™ «GE» NBLUNT) GO TO P1:	RSTER	87
	COMMON /MOUNDS/ X8GD(130); YR99(130); YSHK(130); YSHK(130);	ROUNDS	ź	V2=V€(4RMAY,E) GD 70 730	STEP	8.8
	" """AT P M X M AT A C M P G A M R G P M R G P M R M D Y	#31M95	3	Par DO PER JUMPLUNTANXMAX	as tep as yep	9 9
	COMMON /FLOW/ XC(23-103)-YC(23-104)-VF(20-100)-RHOF(20-100) COMMON /ONSTRM/ ZPLOT-NZEMO-NZADD-NXPLOT	FL OV Dhstra	;	TE (XST(TM-1) -GY- YCANDHAY-111) GO TO 02/	RSTEP	91
	LEVEL ZoMMoNMFoXMFoBBFoBLBFoGAMAR	MATE	ž	VZ=VF(MPMAX,JJ-1)+(VF(MRMAY,JJ)-VF(MRMAX,JJ-1))	STEP	45
	COMMON /9YAL/ NR, MSF(51), XSF(51,100), RSF(51,101), FLBF(51,101),	RVAL	i	• +(YTTTH, 1) -XC(MRMAY, JJ-1))/(XC(MRMAX, JJ1-XC(MRMAY, JJ-1)) 69 TO 730	957EP	93
	* GAMAFEST, 100) LEMEL 2, KST, MUHST, NET	RVAL	•	PZO CONTINUE	95 TEP	05
	COMMON PRIREAMY XST(50,152), YST(50,152), NUMST(50), NST	STREAM	ζ	73; V1=V2	AS TEP	96
c		STEP	14	¥1=¥\$T(TM;K\$T+1) ¥1=¥*T(TM;K\$T+1)	4 C TEP PS TEP	97
ç	SECOND FIELD LINE IS TANGENT TO SHOCK HOSE	MSTEP MSTEP	15	V2-VI 4TP P ( X I , Y I )	AS TEP	90
	JAF#4Y=QQ	ASTEP	16 17	PST=SQRT((YST(]#,KST+1)=X*T(]#,KST))**2	RSTEP	100
	WR-#IN1(7PL 0T +10.0+14.0+30.0)	P\$150	î÷	<pre>* +{Y\$T(I m, K\$T+1}-Y\$T(IM, K\$T))**2) nT*2.0*n\$T/(Y3+V2)</pre>	PS TEP RS TEP	101
	YSHK7ayr(Nemata)	RTTEP	10	A={V?-V;}/OT	RSTEP	172
	OSTNEHER TYTENSTY 19-XSHK23/EFLOATENS 1-1-53 NELT-OSTNE	ASTED BSTED	20 21	THE W- TOL D+DT	42166	104
c		ASTER	22	TF(TMEM.GE.DELT) GO TO 746 KCT-KST+1	ac ted	105
Č	CALCULATE WHERE VERTICAL FIFED LINES ORDSS SYMMETRY AXIS	ASTER	2.3	TOLO-THEW	95759	176 107
	PR 609 Jel, JRF4AX	RSTEP	24	TE (KST .GE. NUMST(IN1) CO TO 76	85759	176
	986(),33=5.c	STED	26	AN TO 73C 743 J=J+1	STEP	119
e c c	: CONTINUE	RSTER	77	71* 95LT+TPLD	95750	110
	YRF(1,2)=YSHKZ-DS(NF YRF(1,2)=YSHKZ	RSTED RSTED	2.0	"FL	RSTEP	112
c		ASTEP	3r	Y*F(T, 1) = XS T([M, KST) + DELS+(XST([M, KST+]) - YST([M, KST]) / NST	STEP	113
Ç	ASSUME CONSTANT DECELERATION BETWEEN FRITH POINTS	45T=#	37	PRF(T+J)=YST(TM+KST)+DELS+(YST(TM+KST+1)=YST(TM+KST))/DST TOLD=TNEW=DELT	45 TEP	114 [15
•	1•2	RSTER	17 31	45T=45T+1	*\$ TE *	114
	TDLD+0.0	STEP	34	TE (KST .RE. NUMST(TM)) GO TO 760 75) TE (J .GE. JSEMAK) GO TO 760	95 759	117
	10=M04A4	95TFP	3 "	TE CTOLO OLTO DELTE CO TO 730	45750	114
611	V2=V6(TP,1)   V1=V2	457E# 457E#	3 6 3 7	3=1+1	ASTER	119
	[R+[Q+]	RETER	31	V1=V1+4+97	45 TEO	181
	IF (19 .L. 0) 60 TO 640	STEP	30	<pre>xwe(1,1)=xwe(1,1-1)+DEF2+(h21(im*k21)-xc1(im*k21-1))\u0041 UEf2-A1+UEf1+7-2+VeUEf1+DEF1.</pre>	ASTEP ASTEP	122 123
	W==VE(T0,1) "T=".D=(YC(T0,1)=XC(T0+1,1))/(V2+V1)	45TEP 45TEP	41	~~~!!   J    ~~!   4~!   40 EL 5   (42 L ( IW   K2 L) - A L L L A   1   1   1   1   4   4   1   4   4   4	95 TEP	124
	4={V2-V1}/OT	ASTER	42	TDL ^= TOL D=D EL T	ACTED	125
	TPEW=T7LD+9T	RSTER	43	60 To 760	45759	124
	IF (TYLW .GE. DELT) GN TO 623 Thlo-thew	4572p	44	763 CONTINUE	ASTER	129
	50 70 616	# TEP	45	MRE(T)=j	PSTEP	129
f 2.	NT=OFLT=TNLD	95760	47	TF (J GCT. NAF([=1)) NAF([]=NAF([=1) TGU CONTYNIE	45 TEP	130
	9ELS=VI=0T+(145=A=9T=9T J=J=1	95TE*	4 R	DETIION	RSTEP	131
	YPF(1+1)+YC(TP+1+1)+DELS	93729	5"	FND	NS TEP	132
	TOLDOTNEW-DELT	STFD	51			
63.	) TF (1 .GE. IMFWAX) GD TO 640	ATTER	52			
	<pre>!F (TTLD .LT. DELT) GO TO 610 v: ************************************</pre>	451E# 457E#	5? 54			
	DELS-VI-OFLT+C.5+4+NFLT++2	RSTER	55	SUMMOUTING AUMAL(4,5,8,K,TLB,NLAM)		_
	TOLP=TOLD=DELT DT=DELT	451EP	55 57	τ	41441	,
	3-3-7	451#0	50	C MISTING A RUGALE TECHNIQUE, THIS ROUTINE TORTS THE REAL	#U = 3 E	
	YAF(1, 11 - YAF(1, J-1) + DELS	RETER	50	C APPAY S INTO ASCENDING DROPE AND CHANGES THE ORDER OF APRAYS A AND B IN A CORRESPONDING	4194[	
64.	GO TO 630 CONTINUE	RSTEP RSTEP	60	C MANASTA K ES THE NUMBER OF DATA POINTS TO	41184	•
•	N9F(1)=J	RSTED	51	C AF SORTED.	811891	•
	T+1	ASTER	53	TIMENSION Aftherfalenfaletings	AIFRE	
ŕ	CALCULATE WHERE VERTICAL FIELD LINES CORSS STOFAMLINES	RETER	54	· ·	9799L 9788E	1^ 1:
C		95760	65 66	TF(K-FO-1) RITURN Kl=K-1	egent	12
	DD_70G_EM=1,48T	P\$7#P	67	00_100_I=1.K1	RIFRAL	17
	T=1M+1	RSTEP	6.	L•I+1	bild of F	14
	#RF(7,1)=#\$4KZ-DSINF R9F(7,1)=Y\$T(1M,1)	ASTEP ASTEP	69 7ú	no lin Jelyk	40.46	19 16
	44E(1'5)=22H4S	RSTEP	71	TF(S(3).GT.S(1)) GO TO 100	911991	17
r	enf(1,2)=v\$T(1H,1)	85759	72	C THTE*CHANGE ARRAYS	80 8 8 E	1.0
è	LOCATE POINTS REFORF SHICK WAYE	9STEP 9STEP	73 74	C TEMP=S(T)	4944	20
C		ASTE .	75	2413-243)	913 = 9 [	21
					*****	22

		90 094	29	WF - WA 64 WA	
	TEMP=4(1)	80991	24	"1=467(H) "2=467(H+1)-1	CONCUT
	A(T)-A(J)	RUBBL	25	TECTPLOT.E0.21 GO TO 30	CONOUT
	V(1)-16mb	9U83L	26	TF (TPLOT .GT. 4) GO TO 35	CONDUT
	TEMP+9(I)	9U 99 L	27	TVAL=1.C+FACT+(1.D-CVAL(N)++2)	COMMIT
	9(1)-9(3)	9999 <u>1</u> 89941	2 A 2 A	WEITE 16,4301 MP, CVALINI, TVAL	CUNDUL
103	REJOETEMP Dentique	911881	10	GO TO 43 30 WPITE(6,510) NP,CVAL(N)	CONDUT
c 103	A CHAILING	Bungt	91	GO TO 42	COMMONT
•	PETUPY	9() <b>99L</b>	32	35 TF (IPLOT .EQ. 5) WRITE(A.620) NP.CVAL(N)	CONDUT
	END	RUBBL	33	TF (TPLOT .EO. 6) WPITE(6,630) NP, CVAL(N) IF (TPLOT.EO.7) WRITE (6,653) NP, CVAL(N)	COMOUT
				I	COMOUT
				40 TF(N4INNY,FG.1) GO TO 45 WRITE(6,420)	CONDIT
				GO TO SP	CONTUT
		CHECK	2	45 WRITE(6,425)	CONCUT
c	CHECKLICAK*MAA*KODS*1*K*MAF*KUDA)	CHECK	ś	5) CONTINUE	COMBUT
ċ	CONTOUR PROGRAMS HAR, WALM, SERCH, ENTER, AND CHECK	CHECK	i i	V*fff(5,433) (CONTX(F),CONTY([),[=#1,#2]	CUMULL
č	WESTTEN BY REESE STRENSON, NASA-AMES RES. CTR AUG., 1974.	CHECK	•	NVD(3)=MNVA T CONTINUE	CONSIST
č	(MODIFIED VERSION)	CHECK	6	C	CONTUT
C		CHECK	7	Č PESTOPE STAN OF X	COMPUT
ç	GTVEN THAT A LIME PASSES THROUGH AM INTERVAL UMBER INVESTIGATION, QUESTION IS IT A MEM LIME, OF IS IT	CHECK	:	č	COMPUT
	PART OF A LINE ALREADY RECORDED.	CHECK	10	70 3 J+2, J44t	CONSUT
č	Late Mr. 4 Flue Merchal Decologies	CHECK	ii	3 CONTX(J)==CONTX(J) RETURN	CONCIT
ć	KUNG -1 UK, HEW POINT.	CHECK	17	C .	CONDUT TUONOD
۲.	KUNG =2 RAD, DEN POTNT.	CHECK	13		CONSUL
¢		CHECK	14 15	<ul> <li>low, is, esh Vilocity (Timegrature) contour lines count);</li> </ul>	CONSTIT
c	DINENSLUN ICAK(4*1)	CHECK	ié	41) FORMATC///5%,13,354 POINTS IN CONTINUE LINE OF V/VINE =,67.3.	CONSUT
	77 1 L+1,444	CHECK	17	• 114, T/TINF *,F7.3//) 422 F0PMAT(14x,34x/0,17x,340/0/)	CONTIL
	TECHODENE TCHK(1,L)) GO TO 1	CHECK	1 *	425 FORMAT(14%, 44X/RO-16X, 449/P)/1	CONOUT
	TECU-NESTCHKCZ-LID GO TO I	CHECK	30	433 FOPMAT(97,F13.4,137,F13.4)	CONTUT
	TECK. NE. ICHK(3,L)) 60 TO 1	CHECK	\$1 27	500	COMPUT
1	TF(NVAL.EG.SCHKE4,L1) FO TO 2	ryerk	2 ?	• 10x+T3+Z8H DENSTTY CONTING LINES FORING)	CONDIT
•	x(0)3-1	CHECK	2.9	510 FORMATC///5%, 13,394 POINTS IN CONTOINE LINE OF RHO/PHOTHE *,F7,3//) 610 FORMATCINE//59%, 2944AGNETIC FEELD CONTOINES/53%, 23(144)//	CONOUT
	GO TO 3	CHECK	2.4	* 13x, 13, 354 MAGNETIC FIELD CONTOUR LINES FOUND!	CONOUT
2	nuud=5	CHECK	25 26	* 14x, 33H FOR COMPONENT ALONG FTELD ITNES ,	CONDIT
3	PETURN	CHECK	źź	• 314PAPALLEL TO FLOW IN FREESTREAMIN	ころりつりて
	END	C - C	-,	613 FREWATTIMI//10x, E3.354 MAGHETTE FIELD CONTOUR LINES FOUND!	THENDS
				<ul> <li>14%,33H(FOR COMPONENT ALONG FIELD LIMES,</li> <li>36HPERPENDICULAR TO FLOW IN CARGOTREAM);</li> </ul>	CONGUT
				EZA FORMATO///5X, 13,344 POINTS IN CONTOUR LINE OF RAINE ,	CONTIT
				1 124(************************************	CONDIT
		COMPUT	,	636 FORMATE///5% 13,344 POINTS IN CONTOUR LINE OF BURINE,	しひかいけん
	SUAPRIVITING CONDUT (ACONT, FACT, NHINDX)	CUNJUL	•	1 THEPERPENDICALIPT =,FT-3//1 640 FORMATICHAY/ACK,T3,354 MAGNETIC FIELD CONTOUR LINES FOUND/	CONTUIT
č	THIS ROUTINE WRITES OUT THE CONTOUR LINES FOUND BY	COMPUT	4	• 144,334(FDB COMPONENT ALONG FIELD LINES .	CONDUT
č	SURPOUTINE MAP	TUGHES	•	· 294HTRHAL TO FLOW IN FREESTREAT)	CONTUS
č		COMPUT	6	650 FORMATI//5x, 13,344 POINTS IN CONTOUR LINE OF MISSINE,	CONSUT
	COMMON ATCHECKA TCHK(4,13ED)	TCHECK PLOTC	?	104(40R#4[] #,F7.3//)	てロリコウオ
	CHMON PPECTC/ CONTYCLOGO), CONTYCLOGO), CVALCACI, NADCACI, TPLOT	COMPUT	<b>6</b>	cau	てりもつりす
	NIMENSTON ACONT(1)	CONQUIT	12		
ċ	WRITE HEADING FOR THIS SET OF CONTOURS	CONDUT	11		
č		C343117	12		
	HHAY-MAD(1)	CUAJIII	13	CHECHTONE CONTR	CONTR
	TF(TPLOT.FG.2) GO TO 13 TF (TPLOT.GT. 4) GO TO 15	CONOUT	15	•	CONTR
	ABILE (9.400) MWX	COMPUT	16	C THE SHAROHTEME PLOTS AND LABELS CONTOUR LINES.	CONTR
	40 TO 25	CUMJIIT	17	C ALCO DRAWS FIELD LIMES FOR MACKETIC FIELD STRENGTH PLOTS.	CONTR
1	. WRITELE, SOOT NMAX	CONOUT	15	C UCC PLOT SUBROUTINES USED ARE	CUMIA CUMIA
	en to z:	COMPUT	20	C DOTLN, NUMPLT, VECTOR.	CONTR
1	5 TF (TPIOT .EQ. 5) WRITE(6,600) NMAK TF (IPLOT .EQ. 6) WRITE(6,610) NMAX	CONDIT	21	n[#E45[ON 451253],451353)	CANTR
	TE (TPLOT-EQ.T) WRITE (6.64G) WMAY	COMMUT	2?	COMMON /LARES/ YEAR/301, YEAR/301, CV6301, NOL, TER(301, NEAR	LAPLS
,	CONTINUE	COMMIT	23	CUMMUN \ZCFF XZE XZE XZE XHAX YHAX, XLHCTH, YLHCTH	3541.5
c T		CONGUT	24	[EVEL 2,MM.MSF,YMF,PRF,FLMF,GAMMF COMMON /MVAL/ MM,MMF(52),YMF(5],174),AMF(51,100),ELMF(71,100),	RVAL
Ç	PERENCE SIGN OF X FOR OUTPUT	CUNDIT	75 26	• GAMAR(51,100)	SVAL
c		COMOUT	27	COMMON JOHSTRMS FRLOTHMIZENDAXADIOT	DHSTON
	JMAX=MAD(HMAX+1)-1	COMPUT	7.0	<pre>common /mounds/ xmoo(1ab)yYmoo(1ac)yFsHK(1, &gt;)yYsHK(2() );</pre>	POUNDS
	5 CONTA(1)=-CONTA(1)	CONDUT	29	<ul> <li>MRMAY, MYMAY, AMACH, GAMMA, MPD, NHTNDX</li> </ul>	adimos
		COMOUT	30	LEVEL 2, 45T,45T,4U45T,45T COMMON JSTREAMJ 45T(50,152),45T(56,152),4U45T(5);4ST	STOFAM
c	POINT CONTOUR LINE FOR EACH VALUE	<u> </u>	31 32	CUMMUM \PFOLC\ COMIX(100=)*CUMIX(101)*CAR((34)*WYO(34)*LFFUL	PENTO
		CONTUT	33	C	CONTR
	MARKET 1-1				CONTR
	WIU(1)-1	CHANUT	34	1=(1PLOT==0.3) GO TC 7)	
	MAN(1)=1 70 1 M-1;MMAX MP-MAN(M-1)-MAN(M)	CONTUT	35	c c	CONTR
	00 I N-1, MMAX  MP-MADIMAIN-104ADENS  MC-MAT-MADENS	TUCPED	35 36		CONTR
	no limijamak Mp=manimati=manimi	CONTUT	35	c c	CONTR

**>.** 

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	IF (YSX800 . 245 CONTINUE	1)+(Y5(N)-Y5(N-1))+(X90D(J)-X5(N-1))/(X5(N)-X5(N-1)) LTo Y80D(J)) N1=N	CONTR CONTR CONTR	191 192 193			TO 110 T=2,MRMAF ASCA(I,J)=BPERP(I,J) 10 CONTINE	CONTUR CONTUR CONTUR	66 67 68
	ng 250 NeN1,		CONTR	194		•	CALL MAPISSEM, 22. CONTY. CONTY. KBCOM, 2. SCOM. NAD. 1000.30. TCHK.	CONTUR	69
	253 CONTINUE	5 (4), 45 (4), 45 (4,4), 27 (4,1), 27 (4)	CONTR CONTR	195 196			• 2,1,NRMAX,NYMAX) TPLOTe6	CONTUR	70
	22. CONTINUE		CONTR	197			TF (LPRCON) CALL COMOUT(SCOM, FACT, NHEMOY)	CONTUR	71 72
c	*ETUP N		CONTR	198			IF (LPLOT) CALL PLOTCH	CONTUR	73
٠	END		CONTR CONTR	199 200			NO 120 J=1,*NXMAX NO 120 T=2,*NAMAX	CONTUP CONTUR	74 75
							#SC#(I+J)#9HOR#(I+J) .	CONTUR	76
						13	2) CONTIMUE	CONTUR	77
							CALL MAP(MSCM, 20, CONTX, CONTY, KROON, Z, SCON, NAO, 1000, 30, 1 CHK, 2, 1, NRMAX, NXMAX)	CONTUR CONTUR	79 79
							TPLOT=7	CONTUR	90
_	SHEROUTTHE C	THTU?	CONTHR	Z			TE (LPRCOM) CALL COMOUT(SCOM, FACT, NHIMOX)	CONTUR	•1
Č	SHERDITTHE C	ONTUR CONTROLS CALCULATING AND PRENTING THE CONTOURS	CONTUR CONTUR	i		С	IF (LPLOT) CALL PLOTCH	CONTUR CONTUR	#2 93
r		AND CREATING THE PLOTS	CONTHR	5			DJ. CONTINUE	CONTUR	94
c	******	1400 ANCH PRODUCTOR 1311	ela Conida	ė			IF (1 PLOT) CALL EMPLT(3.0,0.6) RETURN	CONTIJE	45
	LEVEL 2. 4PA	ANGPJA NGNJESCON JSCON (23) PAJ PPERPJSNORMJENAGJSANG	#C0482	ž			chu chu	CONTIIR CONTUR	*6 97
	COMMON /4C3M	PS/ RPARA(20,100%, RPERP[20,100%, RNGPM[20+1,46%,	BCOMPS	3			•	•••••	
	* AMIG(20.10	0),9ANG(20,190) DS/ x8g0(1961,78g0(1961,49HK(!631,49HK(1961,	90 74 PS 87040S	;					
	* MRMAY, NYMA	X * WHYCH * C YMAY HED * MHINDX	ROUNDS	;					
	COMMON /CONT	/ KYCON+VCBN(701,KRCON,RCBN(201	CONT	Ş					
	COMMON /FLOW	/ YC(20+100}+YC(20+196}+YF(20+1)91+RHNF(21+160) RH/ 7PLNT,H7EHD+H7AP9+HXPLOT	FLOW DMSTRM	?		•	FUNCTION DROXEX, Y)	DRDY DRDY	Ş
	FORMON /PLOT	C/ CONTX(10C)),CONTY(1(_)), (VAL(3C),NAO(3C), [PLOT	PLOTC	į		ř	THIS FUNCTION DETERMINES THE SLOPE OF THE STREAMLINE	ORPY	,
	LOGICAL LRER	UM#EPRFE#EPPST#EPPCON#EPPP#EPLOT#ETRAJ#EPSTRT	PPOPT	2		C	AT THE POINT (X,Y)	DRINK	5
	CUMMUM 16606	T/_LRSRIN,LPRFL,LPRST,LPRCON,LPRG,LPLGT,LTRAJ,LRSTPT- ,YST,WIMST,MST	STREAM	,		c	COMMON /ALUNT/ THETA(25), PP(20, 251, NALUNT	DRD¥ 9LUNT	6
	COMMON ISTRE	AM/ XST(50,452),YST(50,152),HUMST(50),MST	STREAM	j			COMMIN / MUMOS/ XBUD(100), Y900(100), Y54K(100), Y54K(100),	ROIMOS	ź
	COMMON STONE	CK/ TC4K(4,1900)	TCHECK	2			* MRMAY, NYMAY, AMACH. GAMMA, HRD, NHENDY	900495	3
С	DIMENSION WZ	C7(20,10G)	CONTUR	17 18			LEVEL 2, AMG.DXTH.DEG COMMON FORDE AMGEZO.1001,PXTHE1031,DEG	gen Den	?
c	PLOT STREAML	IHES	CONTUR	19			COMMON /FLOW/ XC(20,100), YC(2), 100), YF(20,100), RHOF(20,100)	FLOW	ż
C			CONTUR	2.		۲	LOCATING POINT IN GRID	DEDA	11
	1	ALL SECALCIZENK, YSHK, NYMAY)	CONTUR	? 1 ? 2		Ċ	Co. silve sold in exto	DEDA	12 13
	TF (LPLOT) C	ALL PLOTCH	CONTUR	23		•	*# (* .RF. 3.6) GB TO 16	DRDY	14
ç			CONTUR CONTUR	24 25			THTA= 4T4H2{Yy=Y1+95G R=500T(Y++2+X++2)	DRDY .	1.9
ċ	CALCIILATE VE	LOCITY CONTOUR LINES	CONTUR	2.4			TO 3 J-1, NECONT	UBUA	16 17
c	1661	D IS HRMAN BY HEMAN)	CUNTIL	27			TF (THETA(J).GT.THTA) GO TO 5	DROT	1.
r	TE (KACUN "F	E. C) GO TO 16	CONTUP	?*			3 CONTINUE	DEDY	54
	TALL MAP(VF,	20, CONTX, CONTY, KYCON, 2, YCON, NAM, 1L, 30, TCHK,	CONTIN	31			5 10=1-1	DROX	ž٠
_	* 1,1,NPH	AY, MYMAY)	CUNTUR	3? 32			TF (JP-1T-1) JP-1	09.04	22
ċ	PLOT VELOCIT	A THU LEMBENTANE CUMITION	CONTIN	35			\$1	0474 7471	23 24
č	• • • • • • • • • • • • • • • • • • • •		CUNTIL	14			79 7 [#7, HRMAX	Debx	24 25
	TP[GT=]	MMA-1.C3+AMACH+AMACH	CONTUP CONTUR	3.5 3.6			91=92 92=99(I,J9)+889(I,J8+1)-99(I,J8))+5109E	08 04 08 04	26
		CALL COMMUTIVEDM, FACT, NATIONS	CONTUR	37			TF (#2 .6T. 41 GD TO 8	0404	27 28
	TF (LPLAT) C	ALL PESTON	CONTIN	31			7 CONTINUE	Deva	20
c	CALCULATE OF	MSITY CONTOUR LINES	CONTUR CONTUR	39 40			Tenemax 3 GO TO 21	DRDY	30 31
ř			CONTIJE	41	(	c		nene	12
	10 IF EKANON .E		CONTUP	4?		1	) CONTINUE	9894	33
	* 1.1.489	F,20,CONTX,CONTY,KPCON,2,PCON.NAT,130;,37,TCHK; AX,NXMAX)	CUMINA	43			ng 13 Jangling, nyagy	DROY	34 35
c			CONTHR	4.5			TE (YCCL) J) . ST.X) GO TO 15	DRNX	36
ç		COMTONES	CONTUR CONTUR	46.		1	T=MAAAA 3 Cumiinie	neng	37
c	TPL07+2		CONTUR	44		1	5 JR+J+1	DWDY DWDY	14 30
	TF (LPGCH4)	CALL COMOUTICOM, FACT, NUTHORY)	CUNTUR	49			TF CJP.LT.HALUMTI JP=HALUMT	DRDY	40.
-	IF (LPLNT) C	ALL PLOTEN	CONTUR	50 51			#S-AC(1*1=)+(AC(1*18+11-AC(1*18)1+2FUbE 2FUbE-(X-XC(1*19)1\UXLA(18)	08 0X	41 42
è	CALCULATE, P	RINT, AND PLOT CONTOUR LINES FOR PAPALLEL	CONTUR	52			70 17 T+2,494AX	2601	43
c	THU BESBEHUI	CILLAR MAGNETIC FIELD COMPONENTS	CONTUR	53			P1 - P2 -	DROY	44
ſ	ZJ TF (KRENN .L	E. P3 CD TO 263	CONTIN	54 95			P2=YC(T,J9)+(YC(T,JP+1)-YC(T,JR))+SLOPE TC (P2 .GT, P) GO TO 18	DROY	45
	70 100 J=1, N	XMYA	CONTUP	56		1	7 SUNTINUE	UBUA	46
	nn 109 T=1, N	e max	CONTUR	57			T = M RM AX	DRNX	48
	SCHIT, JI-RP	(L ₁ J)A#A	CONTUR CONTUR	58 59			3 CONTINUE	DERX	49 50
	CALL MAPINSC	M, 20, CONTX, CONTY, KBCON, 2, RCOM, MAD, 1000, 30, ICHE,	CONTUR	60	•	¢	SIVARIATE LINEAR INTERPOLATION	DRDT	51 51
	+ 1,1,484	AT, NXMAY)	C DHTUR CONTUR	61	•	c,	O CONTINUE	DROT	52
	1910T=5 16 (198CD4)	CALL COMOUTISCON, FACT, MILMON)	CONTUR	62 63		•	DP1=AMG(T-L+JR+(AMG(T-L+JR+1)-AMG(T-L+JR))+SLMPE	DRDY	53 54
	IF (LPLOT) C	ALL PLOTEN	CONTUR	64			0R2-ANG(1,JR)+{ANG(1,JR+1}-ANG(1,JR1)+St 0+E	DEDA	55
	. ng 110 J-1,4	XMAX	CONTUR	65			DRPY=081+(9#2-DR3)+(8-83)/(#2-81)	DRDX	56

	<b>PETURM</b>						
	FND	DS DX DG UX	57 98	c	SUBROUTINE EXTRAP	EXTRAP	
				č	THIS MOUTINE CALCULATES EXTRAPOLATED VALUES OF	EXTRAP EXTOAP	
				č	RMD AND W/W AT POINTS ALONG THE BUTHDARY THETA-? USING	EXTRAP	
				c	A LAGRANGIAM INTERPOLATING POLYNOMIAL TYPE	EXTRAP	
				Ç	THREE UNEQUALLY SPACED POINTS ON EACH RADIAL CURVE.	EXTRAP	
	**********			C		EXTRAP	
	SURPOSTINE ECHINA	D& D.f.	59		COMMON /BLUNT/ THETA(25).RP(20,25),NBLUNT	AL UNIT	
	987MTP THENT CLASS HERE COS DIM	DRDY	60		COMMON FROUNDS/ XSOD(188), YBOO(188), XSMK(188), YSMK(188), WMAX, AMACH, GAMMA, MRD, NHINDK	800475	
	PPINTS INPUT CARDS USED FOR RIM	DRDX	61		COMMON /FLOW/ XC(29,100), YC(29,100), YF(20,100), RHDF(20,100)	8 0UNO S	
	TEMPHSTON CRO(4)	DADA	62 63		COMMUN /SHOCKS/ DESDX(130), DST(50)	FLOW SHOCKS	
	UPTTF (6,110)	DRPX	64	c		EXTRAP	
13.	CONTINUE	DROX	64	Ç	CALCULATE LAGRANGIAN COEFFICIENTS	EXTRAP	
	4E4D (5,138) CRD	DRPK	66	С		EXTRAP	
	YES, NO	DRDY	67		THESETHETA(2)-THETA(3)	EXTRAP	
	TF (EDF(51) 30,20	DRDY	6.0		TM24-TMETA(2)-TMETA(4) TM34-TMETA(3)-TMETA(4)	EXTRAP	
23	CONTINIE WAITE (6,131) CRD	DROY	69 70		E2-TMETA(3) +TMETA(4) / (TH23-T424)	EXTRAP	
	ED 10 10	DROX	71		F3-THETA(2) +THETA(4)/(-TH23+TH34)	EXTRAP	
3.3	CONTINUE	DRAY	72		F4=THFT4(2) +THET4(3)/(TH24+TH34)	EXTRAP	
	PENTHO :	DROX	73	c		EXTRAP	
	R & T UP N	DEDY	74	c	CALCULATE XC, RHO,AND V AT THETA-D.	EXTRAP	
100	FDRMAT(8419)	DRDX	75	C	ANA ANA ANA	EXTRAP	
C1	FORMAT(11.6A10)	D9 (0X	76		ANZ-AMACHOAMACH	EXTRAP	
	FREMATELMI, 40%, 35MLISTING OF INPUT CARDS FRE THIS RUM/40%, 35(1M+)	DROY	77		70 17 F=2,NRMAX YC4I,11=G.0	EXTRAP	
	[ ///) FND	DEDA	78			FYTRAP	
	540	Deux	79		XC(T,1)==(E208P(T,2)+E308P(T,3)+540RP(T,4)) RP(To1)==XC(Tp1)	EXTRAP	
					TF (I.FO.HRHAY) GO TO 10	FETRAP	
					*HOF(1,1)=E2+P47F(1,2)+E3+RH7F(1,3)+E4+RH7F(1,4)	EXTRAP	
					VF([,1)=E?*VF([,2)+E3*VF([,3)+E4*VF([,4)	EXTRAP	
					in (V=(i)1) .LT. 0.) V=(i,1)=0.	EXTRAP	
	SURGULTHE ENTERCHOOZ, J, K, NVAL, AZ, AZ, JREW, KREN, ECHK, KOO4, X, Y, NEV,	ENTER	2	c	1% CONTINUE	EXTRAP	
	4 CONT. 13171)	£4788	á	Ļ	CALCINATE CHART THE AT AND AT AND	EXTRAP	
		ENTER	i	÷	CALCULATE EVACT VALUES AT SHICK WAVE	EXTRAP	
	CONTOUR PROGRAMS MAP, WALK, SERCH, ENTER, AND CHECK	ENTER	Š	•	*HDF( WPMAY, 1) = (GAMMA+1.) *AM2 /( (GAMMA-1.) *AM2+2.)	EXTRAP EXTRAP	
	WRITTEN BY PEESE SORENSOM, MASA-AMES RES. CTR., AUG., 1974.	ENTER	6		VF(NR MAX, 1) =1.0/RHOF(NRMAX, 1)	FYTRAP	
	(43ULLED AESZUM)	ENTER	7	£		ETTRAP	
	ASSUMING THAT A POINT ON A CONTOUR LINE HAS BEEN FININD,	ENTER		č	EXACT VALUES AT BODY	EXTRAP	
	THIS SUPPOUTINE RECORDS THAT POINT IN THE ROOKKEEPPING ARRAYS.	ENTER		C		EXTRAP	
		ENTER	1¢ 11		YC(1-1)=0.0	FYTRAP	
	COMMAN AREANA XCESO, 1031, YCES7, 1271, YFES3, 1001, RHOFESO, 1C01	FLOW	*;		YCC1-1)==1-3 PP(1-1)=1-6	EXTOAP	
	THENSTON ICHKI4,1), TEL1, TEL1, ACONTEL	ENTER	19		VF(1,1)=0.0	EXTRA	
		ENTER	14		440F(1,1)=440F(N0 MAX,1)+(GAM44+1.0)++2+47+0.5/(Z.C+GAM44+A)2-	PAPTYS PAFTYS	
	MAA-WAA-J	EALÉS	15		* (SANNA-101))**(101/(GANNA-107))	FYTRAP	
	TERMEY-GT-ISIZI) ON TO 1	FHTER	16		N#SNY (11=9999-0	EXTRAP	
	[CHK(1, NYY) =KCD2	ENTER	17	Ç		ETTPAP	
	TC4K(2,WYY)=3	ENTER	10	Ç	DEFINE POUNDARY ARRAYS FOR IONOPAUSZYMAGNETOPAUSE AND SHOCK	EXTRAP	
	TCHK(3, MXY) =K	ENTER	19 2(	c	00 01 120 MM219	FETRAP	
	TCHKE 4, MXY) -MYAL	ENTER	71		MARKHALL CS OF	EXTRAP	
		ENTER	22		YAQQ(3)=YC(1,3) YAQQ(3)=YC(1,3)	EXTRAP	
	IF ENDODINTS ARE EQUAL, ENTER WIDPOINT	ENTER	23		ACHK(1)-AC(HEHVA-1)	EXTRAP	
		ENTER	24		YSHK(J)-YC(MRHAX,J)	EXTRAP	
	TE (( A2-41).E0.0.0) 60 TO 6	EALES	25		20 CONTINUE		
	97F=(4C9HT(HY4L)-41)/(AZ-41)	ENTER	26	c		EXTRAP	
	FO TO (2,3).KOD2 DIF=0.5	ENTER	27		•ETU•N	FXTRAP	
	40 TO (2,3),KON2	ENTER	28		FND	EXTRAP	
	· · · · · · · · · · · · · · · · · · ·	FHTER	2 <b>9</b> 3 0				
	INTERPOLATE FOR CONTOUR POSITION	ENTER	31				
		ENTER	32				
5	AS+AC(1*k+1)	ENTER	33				
	A5=AC(1)*K+T)	ENTER	34		CURROUTTNE FLOUT		
	60 TO 4	ENTER	35	c	POSSITING TEOUT	FLOUT	
•	Y2=YC(J+1,K)	ENTER	36	č	THE ROUTINE PRINTS THE FLOW FEELD VALUES WHICH WILL HE USED	FLONT	
	45+4C(1'k)	ENTER	37	č	TO CALCULATE THE STREAMLINES AND CONTOURS	FL MUT FL MIT	
7	Y1-YC(J,K)	ENTER	38 39	c		FLOUT	
	x(mxx)=x1+D1t+(x5-x1)	ENTER	40		COMMON /ALUNT/ THETA(251,PP(23,251,N9LUNT	RLUNT	
	Y(MXY)=Y1+B[F+(Y2-Y1)	ENTER	41		COMMON /BOUNDS/ KRODELODS-VRODELS-VEHELS-S-VEHELS-S-VEHELS-S-	920025	
	KN04+1	ENTER	42		A MANAGEMENT OF THE PROPERTY O	ควบพฤร	
	40 TO 5	ENTER	43		LEVEL Z, ANG, DYTH, DEG	DRD	
		ENTER	44		COMMON /DRO/ ANG(23,100), DXTH(100), DEG	në D	
	WPTTE(6,131)	ENTER	45		COMMON /FLOW/ XC(20,100), YC(20,100), YF(20,100), RHOF(20,166) LEVEL 2, YX,YY	FL DV	
01	FORMATICA ONLONGOUR SEARCH AGORTED - TABLE OVERFLOW IN (X, Y))	FHTER	46		COMMON/VCOMP/ WX(20,100), WY(20,100)	AC Date	
	<b>₹</b> 7D4•?	ENTER	47		COMMUN JONSTRAS TPLOT, NTEND, NTADO, NXPLOT	AC OH b	
	CONTINUE	ENTER	40	c		DHSTRM FLOIFT	
				è	PRIVERSE SIGN OF XC FOR OUTPUT	FLORT	
	RETUPN	ENTER	50	ě			

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J#AY-47FN9+NZADD
 FI MUT
 FLOUT
 OO 2 TOTOMPHAY
 FL RIT
 2 XC41, | 1 -- XC41, 3)
 FLOUT
 EL PUT
 PRINT VALUES ALONG SYMMETRY AXIS
 FLOUT
 FL DIT
 FACT-2.5+(SAMMA-1.23+AMACH+AMACH
I*(NHINDX.EQ.1) GO TO 16
 FLAUT
 FLAIT
 WRTTE(6,273)
 FLOUT
 cu tu 5
 FLOUT
 13 WEITERA, 2303
 EI OUT
 00 30 TeasHPHAX
 FI RIT
 T=1.2+54CT+(1.6-VF([,1]++2)
 FLOUT

 FL OUT
 WPITE(6,200) I. YC([,1), VF([,1), PHOF([,1), T, P
 FLOUT
 FI OIT
 PENT VALUES OVER SLUNT SORY
 FL OUT
 FLOUT
 WPTTF(6,243)
 FLORIT
 NO 40 3-2, WALUNT
VPTTE(6,251) J, THETA(J)
 FLOUT
 FLORIT
 IF(NHINDY.EQ.I) GO TO 50
 FLINIT
 WEITE(6.2671
 FLMIT
 Et OUT
 53 WPITE (6.272)
 60 CONTINUE
 FIRST
 10 40 T-1,4PMAX
 T=1.0+FACT=(1.0-VF(T,J)**2)
P=#H0F(T,J)*T
 CLOST
 FI OUT
 ALPHA-DEROANGET, JT
 WRITE(4,255) 7,49([,1],40([,1],40([,1],44([,1],44([,1],44([,1],4LP4A,
 FLOUT
 • VF(T, 3), R49F(T, 3), T, P
 FLORIT
 FLOUT
 PRINT VALUES FOR MARCHING CODE REGION
 FLOUT
 WPTTF (6,2PC)
 FL DUT
 TO TO JONES, JAK
 FLOUT
 FLTIT
 1F(WHTWO), En. 1) GO TO 8'
 FL OUT
 €L ŪUT
 4817E(6,3(%)
 FL MIT
 80 WPTTE(5,310) JE, YC(1, J)
 FLOUT
 V#1 TE (6, 32))
 90 CONTINUE
 FLOUT
 TO TO THINKMAY
 FERNIT
 T=1.F+FACT+(1.C-VF(T, J)++23
+=R4nE(T, J)+T
 EL PUT
 ALDHA STEGO ANG (T. 1)
 WPTTF(6.2001 T.YC(T.J).YY(T.J),YX(T,J).AL.MA.VE(T,J),PHOF(T.J).T,P
 FLOUT
 CONTINUE
 PESTAPE SIGN OF MC
 FI OUT
 00 3 J-1,J444
00 3 T-1,NRMAY
 FL CIT
 FLORT
 3 XC(1,3)=-YC(1,3)
 FL MIT
 FLOUT
 FIRST
2C7 #RR#4T(2X,T3,10(2X,F10.41)
 FLCTT
21) FORMATCHE//514,204DETAILED FLOW FIELD MITPHIT/514,26(1H41/////
SCH FLOW FIELD VALUES EXTRAPOLATED TO SYMMETRY AVES, ,
 FLOUT
 POHTHETA - D.GC DEEPERS/)
 FLOUT
22, FOR MATCAX, 141, 74, 34X/D, 4X, 54V/VINF, 3X, 174843/P4314F, 5X, 64T/TTNF,
 FI MIT
 FLŅĪT
233 FR#ATC4T; 14[57x, 44P/P3,7x, 64V/VINF, 3x, 164440/P4914F, 5x, 6HT/TINF,

• 6x, 6up/PinF;
 FE QUT
24. FORMATCINI, 412,454FLOW FEELD VALUES FROM ALUNT ROOM CALCINATIONS 250 FORMATCH/214 ANGULAR LOCATION MO., 12, 124, AT THETA -, FF.4.
 Ft (PIT
 FLOUT
263 FNRMAT(4%,14%,7%,44RP/N,4%,34R/D,4%,34K/D,7%,74Y4/V14F,5%,
- 74VY7V14F,3%,104ELDW ANGLE,5%,64VYV74F,5%,104R4D/04D14F,5%,
- 64T/11#F,6%,04P/F)1HF)
 FI GIT
 FLOUT
 FLOUT
273 FORMAT(4x,141,6x,54RP/RC,8x,44P/RG,8x,44x/PG,6x,7HVP/VINF,5Y,
 FLMIT
 . SHAALAIAL'3X' JOHEFOR WHEFE' 2X' PHALAIME' 3X' TUMOHOLOHUIME' 2X'
 FLOUT
 . PHALLARIA PARTER !
 FLOUT
280 FORMATCINE, 41%, 434FLOW FIELD VALUES FROM MARCHING CALCULATIONS
293 FORMATT//384 ADDITIONAL AXIAL LOCATION NO., 12,104, AT Y/D +, F8,4/1 FLOST
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••

32

34

34 37

41

5%

52

55

96 57

5.

63

44

74 77

50

47

99

*1

93 94

95

97

98

```
3C3 FORMATEAY, 141, 7X, 34R/O, 7X, 74VR/VINF, 5X, 74VY/VINF, 3X,
 FLOIT
 * IOMFLOW ANGLE-54,6MV/VINF,3X,10MPHQ/RMSTMF,4X,6MT/TTMF,6X,
 FLOUT
 FIRST
 132
 315 STRWATE // 33H ADDITIONAL AXIAL LOCATION HO., 12, 11H, AT Y/RC =,
 FLOST
 . F8.4/1
 FIRST
 104
 323 FORMATCAX, 1 MI, 7X, 4MR/R7, 6X, 74VR/VINF, 5X, 7HVX/VINF, 3X,
 FLOUT
 . 104ELOW ANGLE, 5%, 6HV/VTNF, 3%, 19HPHO/RHOINE, 5%, 6HT/TINF, 6%, 6HP/PINE)
 FLOUT
 106
 FLMIT
 FLOWST
 SUPPRIUTINE FLOWST
 FLOWST
 THIS ROUTINE CALCULATES THE MAGNITUDE AND DIRECTION DE
 FI MIST
 THE VELOCITY, THEN CALCULATES THE TRAJECTORY STREAMLINES
 FLOWST
 FLOWST
 COMMON /BLUNT/ THETA(25),PP(23,25),RRLUNT
COMMON /ROUNDS/ X90D(100),Y803(100),Y8HK(100),Y8HK(15c),
 BIHMT
 HEMAY, NYMAY, AMACH, GARMA, HRID, NHINDX
COMPON /DNS TON/ ZPLOT, NZEND, NZADD, NXPLOT
 PUMPE
 DUSTR"
 LEVEL 2, ANG, DXTH, DEG
 080
 LEVEL 2, AMG, URTHADES
COMMON (AND) AMG(2),103), DXTM(16,0), DEG
COMMON (FLOV) XC(2),123), YC(2),133), VF(2C,2),231, RMOF(2C,3C,1
 DRD
 LEVEL 2, XST, YST, MUMST, MST
COMMON /STOEAN/ XST (56, 152), YST (56, 152), NUMST (50), NST
 STORAM
 VCOMP
 LEART 5' AX'AA
LUMMUNAALUMN AK(50'1001' AA(50'1001
 ACOUS
 "THENSTON W(201, S(25, 61, AP(51, AV(51
 FLOWST
 14
 2474 W/2501-3/
 FLOWST
 CALCULATE VELOCITY AND FLOW ANGLE FROM VELOCITY COMPONENTS
 FLOWST
 FLOWST
 FLOWST
 POLAR COORDINATE REGION
 šo
 9EG = 7.29577951
 THETA (111-C. 0
 FLOWST
 WY M . V - WY H . V AN 7 A D D
 FIRMST
 FLOWST
 THETACADOTHETACADODEG
 FIRMST
 25
 NYTHE J-1 } -THETACJ >-THETACJ-11
 FLOWST
 70 1. *=1, NRMAX
VF(1,:1)*$70T(VX(1,:1)*+2+VY(1,:1)*+21
 FLOWST
 TF (APELVY(T, J)) . LT. 1.06-4) 60 TO 6
 FLOWST
 2 e
30
 FLOWST
 5 AMF (T. 1)=1....-4
 FLOVST
 13. CONTENTE
 FLOWST
 34
 CYLINDRICAL COOPDINATE PEGICA
 FLOWST
 36
37
 471-451147+1
 OF 21 ICHYLANYWAY
 FLOWST
 741467-13-8662931-466299-13
 FLOWST
 DO 27 TOTAMENAY
 FL INST
 40
41
 VF (T, 11 - 5 18 T (VX (T, 1) + +2 + V (T, 1) + +2)
 FLOVST
 TF (ARTIVELE, J)) .LT. 1.DE-4) OF TO 16
ANGIT, J) - VY(I, J) / VY(I, J)
 FLOWST
FLOWST
 GO TO 2;
15 AME (7, 3) = 1. CE4
 FLOWST
FLOWST
 FLOUST
FLOUST
FLOUST
 27 CONTENUE
 SMOOTH RHOF AND WE ALONG CONSTANT-THETA LINES AT NOSE,
 UTING THIRD DESPEE LEAST SQUARES FIT
 FL OUST
 49
 FLOUST
 51
5?
 CALL FISOTY(MOMAX-3,RP(1,J),R40F(1,J),W,25,S,AR,TER)
CALL FISOFY(MRMAY-3,PP(1,J),VF(1,J),W,25,S,AV-TER)
 FLOWST
 FLOVST
 53
54
 OD 25 THINNENAK
 FLOWST
 VPP-PP[1.1)
 FLOWST
 59
 VF(T, J)= ((&V(4)+XRP+&V(3))+YRP+&V(2))+Y*P+&V(1)
 56
57
 quofit, 11-([api41-xrp+ari311-xrp+ari211-xpp+ari]
 FLOUST
 FL DVST
 54
 STTPAPOLATE FOR VALUES ALONG AXTS OF SYMPETRY
 FL ONST
 51
62
 CALL EXTRAP
 FLOWST
 DO 30 I-1-HRMAX
 FLOWST
 63
 4MS(1,11=6.6
 33 CONTINUE
 FL OVST
 55
c
 FLOWST
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CALCULATE STARTING POINTS FOR STREAMLINE CALCULATION USE GRID POINTS ON SMOCK TO WISE REGION EQUAL Y-SPACING ON SHOCK FORWITHEAD
 FLOURT
FLOWST
 69
 SUBTRUTINE FLEGGY (#, M, X, Y, W, MN1, S1, A, 150)
 EI SOFY

 FLSOFY
 FLOWST
 70
71
 FISOFY
 FLYOFY CONSTRUCTS A LEAST SQUARES POLYMORIAL APPROXIMATION OF SPECIFIED DEGREE TO A GIVEN SET DE DATA POINTS WITH CITY OF THEORY PROVINCIALS.
 NO 32 J-2. WELUNT
 FLEGEY
 FLOWST
 YST(J-1,1)= HC(HPMAH,J)
 FL SOFY
 FLOWST
 73
 YSTE 1-1, 23 - YC CHRMAY, J3
 FI DUST
 74
32 CONTEMIE
 FLEGEY
 FLOWST
 DIMENSION REMINITEMENT STEPHING PARTICULAR CONTRACTOR C
 METAMBI IIMT-
 FLOWST
 7¢
 4005T-51-HST
 CALL FLSOry (M.M.K.F.Y.M.F.MI.P.SIPAP.FET)

HOTT PARAMETERS

H - NUMBER OF DATA POINTS

H - DEGREE OF POLYMONIAL DESIPED, M.LT.H

T - ARRAY OF DEPENDENT VARIABLE

Y - ARRAY OF DEPENDENT VARIABLE

U - ARRAY OF POSITIVE WEIGHTS

MM1 - GOW DYMENSIAM OF SCRATCH ARRAY SI, MN1.GE.M
 FLSOFY
 FL INST
 ON 36 K-MALUNT, WEMAR
TE (FC(1)K) .GT. ?PLOTE GO TO 35
 FL SOFY
 FLOWST
FLOWST
34 CONTENUE
 EL SOFY
 FLOVST
 K-MYMAY
 FI DUST
 41
 FLSGFY
34 VETEONCINDATANT
 FLOWTT
 MYPLOTOR
 FLSGFY
 A3
 FLOWST
 FLSSFY
 VSTW-YSTEMS;;
DRST-AMAK_EVSTW-YSTEMST-1,13,EYSTF-YSTW1FANDST3
 FLOWST
 - SCRATCH ARRAY
 FL SOFY
 10
10
20
21
21
 FLOWST
 IN THE COLUMN DEFINITIONS MILOW,
 FL OUST
 REFERS TO POLYNOMIAL DADES
REFERS TO SOM INDEXING WITHIN A COLUMN
 FLSSEY
 YSTMHYSTM+DRST
TF (YSTM +GE+YSTF) FC TO 45
 FISHEY
 FLOUST
 80
 POLYMONTAL P(T-1), VALUE AT SACOL 1
POLYMONTAL P(T-1), VALUE AT SACOL 1
POLYMONTAL P(T-1), VALUE AT SACOL 1
POLYMONTAL P(T-1), VALUE AT SACOL 1
 COL 1
 FLTQFY
 FLOYST
 27 24 25 26
 45T=#5T+1
 FIRMEY
 EL OVST
 COL 2
 FLSSEY
 OF 37 IX-EX-MXMAK
 COL 3
 ALPHA(1+1), WHERE 1+1=1
BETA(1), WHERE 1=J=1
 FLSOFY
 IF (YSTN . GT. YCCHPMAX, JX1) GO TO 97
 FLOUST
 92
 YSTINST, 1) = YSTN
 FLOWST
 COL 5
 S(I), WHERE I = J-1
SIGMA**2, WHERE I = J-1
 FLSGEY
 27
 94
 FLOWST
 FLSOFY
 FLOWST
 MITPHT PARAMETERS
 SO TO 30
 29
30
 FINNST
 - ARRAY OF COMPUTED COEFFICIENTS
37 CONTENTS
 FLSOEY
 FLOVST
 ATTS THRU ATMACE CONTAIN COMPUTED POLYMONIAL COEFFICIENTS, IN OPDER OF THOREASING DEGREES
39 KYOJY
 FLSOFY
 31
 FLOWST
 9.8
9.0
 TER - ERROR INDICATOR
 TPENT-YCES, NYPESTS
 ELSOEA
 34
35
35
37
30
 FLOWST
 SUCCESS
 FI OUST
 221
 .E0.1 (N.GE.4).7R.(N.L...)
 FLROFY
 CALCULATE STOEAMLINE TRAJECTORIES
USING THIRD DROER MODIFIED SINGS INTEGRATION PROCEDURE
 FLIMIT
 132
 FISGEY
 EL DUST
 .EQ.3 4.LE.1
 FLSOFY
 FLOWST
 134
 FLSOFY
 FLOVST
 195
 BEEFBENCE
 NUBYZ =AMAYI (OUPYI) ZPLOTPocl+1avE=6)
 POLYMONIALS FOR NATA-FITTING WITH A MIGITAL CHARITLE,
 FLSOFY
 4
 ****** 151, 11
 FLOWST
 J. STAND VOL. 5, NO. 2, CHINE 1973 PP. 74-84. MOTE - MOST MOTATION AND MOTE LOCAL VARIABLE NAMES ARE
 45-95T(J5T,1)
 FLTOFY
 FLOWST
 42
43
 109
 FLSOFY
 FLOWST
FLOWST
 MASEN ON THE PERFORMER TE MPP TO WIT, 13-(PILLS, PETLS, MIT W, MT AND WILL PERFOR TO THE WITCHTS ARRAY.
 TF (YS .GT. 2.4) THREEDWAXE
 113
 FFEDEA
 nn 45 4+2,152
 FLOUST
 112

 FLEGEY
 IF EYS+DWRY .GE.ZPLOT) AN TO 47
 FLOWST
 OIMENGEUN X613, Y623, W613, S16M41, 13, A633
 DE-DAGE-2
 FLOUST
 116
 FLSOFY
 10 43 K-1,5
18011-1901(15,75)
 *** INTITAL SET-UP ***
 115
 FLEGEY
 FLOUST
 Y51=Y5+78PY1+NX
 10. 758 - 4
 FLOVST
FLOVST
 117
 FUTOFY
 TF ((N.CE.H).DR.(N.LE.))) 160-1
 FL DWST
FL DWST
 TE (MUT.LT. N) TEROS
 110
 FLSGEY
 Y5=Y5+3.5+fnRDX1+0RDX(XS,YS1))+DX
 TF (YS1.L=. 0.0 .AND. X5.6T.0.3) DEPY-DEPY?
 FLCOFY
 TE (158, NE, 4) 60 TY 99:

METAESS=0, PESS=3, PE=11=0, MEO, DE=SUMEWETED
 FLOWST
 12:
 EL SOEY
 55
56
57
50
43 COUTTWIE
 FIRNET
 24-14-12F312A
 FL OWST
 123
 P=(T4++2(-1)=(WF,F)
 FLSOFY
 124
 FLCOEY
45 CONTINIE
 FLOWST
 125
 *111.41-0.
 FISOFY
 FLOWST
 nso-c.
 ef sota
47 N# (7PL 97-45)+,2
 FI INST
 127
 weren.
 EFZOCA
 FLOWST
 00 115 Jeta#
 FESOEV
 DRDY1=DRDY(X5,YS)
 67
63
 FLOWST
 *1(3,2)-1.
 129
130
 FLSOEV
 XU-IXCED+ SA-USA
 $113,17=C.
 FLSOFY
 64
55
67
57
 FL DUST
 131
 YS-YC+C.5+[02DX]+D@0X{X5,YS1}}+NY
 TF (MT.LE. ...) 65 TO 95:
 FLSOFY
AR CONTINUE
 FLOWST
 YSTEUST, MI-XS
 134
 FLOWST
 113 050 - 050+WT+Y(J)+Y(J)
 EF 43EA
 YST1157. M1- VS
 FLOWST
 135
 WITTELT TOWNS
 FLSSEY
 C *** GENEPATE DETHOGRNAL POLYNOMIALS - THOU PAG ***
 40
71
72
73
74
7
 FLOWST
 136
 FECOFY
5) CONTINUE
 FERMIT
 137
 DO 240 Tel, NI
 FLSOFY
 FLOWST
 CONVERT AND APRAY FROM FLOW FIELD SLOPE TO FLOW ANGLE
 FLOWST
FLOWST
 130
140
 WXPP=3
 FLSOFY
 c
 COMPUTE (WPELLARPETTE), AND OMEGATION (F. P(T))
 TAPENSSEL 28 DE
 FLOWST
 FL SOFY
 OO 60 [=],HRMAX
AMC(T,J)=ATAM(AMG(I,J))
 FLOWST
 142
 TE*****************
 76
77
78
79
 FLSOFY
 FLOWST
 IF ([altami) wxppowyppotimpox(J)oS1(J,2) wypowypotimpoy(J)
 CONTINUE
 FISGEY
 FLOWST
FLOWST
 144
 FL COFY
 ¢
 7(T)=0HEGA(I)/V(I)I
 # ETUP #
 FLDWST
 146
 FERGER
 FLOVST
 c
 DELTA**2(1)=DELTA**2(1-1)-5(1)**2W(1,1)
DSG=DSG-S1(1,5)*S1(1,5)*WPP
 FLSOFY
 41
42
 SIGNA**2(1) -DELTA**2(1)/(DEGREES OF FREEDING)
 FLSOFY
 43
 4144445[4100
```

FLSOEY

	TF (BR.NE.).) BR = DSO/BR	EF 20EA	96	43 IT=I-1	TUTRAJ	33
	\$1(T _p 6) = BR	FLSOFY	67	QI={PZ-#}/{RZ-R1}	LAPTLE	34
C	THPU 240 - CALCULATIONS FOR NEXT I. SKIP WHEN I-M+1	<b>FLSQFY</b>	5.8	MFLAGOU	IJTRAJ	35
С	ALPHACI-11-CUPCII, XPCIII/VCI, I)	FLSOFY	80	RETURN C	LASTLI	36
	15 (1455.W1) GO TO 240 51(1,3)=WXPP/WPP	FLSOFY	90		LASTLI	37
	Abb Da Abb	FL SOFY FL SQFY	91 92	C POINT IS IN RECTANGULAR CHOPOINATE REGION	TJTRAJ TJTRAJ	3 8 3 9
	UPP+A.	FLSQFY	93	50 CONTINUE	IJTEAJ	40
	RT=\$1([,4)	FLSOFY	94	NXI =NAL (INT+1	TITRAI	41
	4L+S1(T,3)	FLSOFY	95	<u>ūū</u> ∳0 jenxī *nxa∀x	TJTGAJ	48
Ç	P(T+1)=(X-ALPHA(I+1))P(I)-BETA(I)P(I-1)	- FL SOFY	96	TE (XC(1.J) .GT.X+) GO TO TO	LAFFLT	43
c	W(T+1,T+1)=(WP(T+1),*(T+1)), B(T+1)=W(T+1,T+1)/W(T,T)	FLSOFY	97	95 CUMITINDE	LAPPLI	44
	nr 230 J=1, m Temp=(x(J)-4L)+S1(J,Z)-RT+S1(J,1)	FLSQFY FLSQFY	98 99	70 JT+J-1	LAPTLI	4.5
	Nb=Abb+A(1)+1EMb++5	FLSOFY	100	03-(YC(1, JT+1)-YP)/NXT4(JT)	LAPTLE	46
	51(1,1)*51(1,2)	FL TOFY	121	Y2=YC(1, JT1+0J+YC(1, JT+1)+(1, J=0J)	LASTLE	49
23	3 51(J, 2)=TEMP	FLSOFY	102	IF (YP .LT. Y2) 60 TO 103	TITRAJ	73
	\$1(T+1,4)*WPP/WPPG	FLSOFY	103	DD 80 I=2,NRMAX	IJTTAJ	50
24	O CONTINUE	EF COEA	134	A1-A5	LAPTLT	51
Ç.	AT COMPLETE COFFETCIFIES OF LEAST SOLIABLES POLYMONIAL	FLSOFY	105	Y2-YC(1, JT) +01+YC(1, JT+1)+(1, J-0))	LASTLI	52
C •	** COMPUTE COEFFICIENTS OF LEAST SQUARES POLYMOMIAL  A = S(C)P(O)++S(N)P(N) ***	FLSQFY	196 197	TF. EY2 .GT. YP3 GO TO 90 PO COMTINUE	TJTPAJ	53
ċ	P(3)=1, P(-1)=3, A(THITTHI)=S(C)=(3)=<(3)	FLSGFY	129	on This	TITRAI	54
•	ng 990 [R+1,41	FLSOFY	โวจ์	90 **= ***	IJTOAJ	55 56
	A(18) = 0.	FLEGFY	110	01=(42-45) ((45-41)	TJTRAJ	57
	\$3 [ 1 m p 1 ) = F a	FLSQFY	111	MFEAGET	LATPAJ	50
36	A. \$1(\$\$,2)#3.	FLEOFY	117	_ PETURN	TITRAJ	59
	\$1(1,2):1.	FLSOFY	113	C POINT TO TWOTHE TOWNSAIRS	LITPAJ	60
ć	A(1)=51(1,5)	ef 20ea Ef 20ea	114 115	C *OINT IS INSTOC TONOPAUSE C	LAPTLY	61
	SUM LOOP THRU 316. I - ORDER OF POLYNOMIAL FORMED	FLSOCY	116	100 CONTINUE	TUTRAJ	62
	NG 310 1=1,N 4L=51(T,3)	FLSOFY	117	atf Vc==;	IJTOA! IJTRAJ	53
	47+S1(T,4)	FL SQFY	110	• cTÚ • N	LAPTE	64
	T2+C.	EFEGEA	119	c	TITEAL	55 56
	11 = 1+1	EF 48EA	150	C POTNT IS BEYOND BOW SHOCK	LAPTLI	57
¢	EQRM P([+1)=XP(])=ALPMA([+1)P([)=RCTA([]P([-1)	FL SOFY	121	C	LAPLI	6 P
c	AND ADD TO POLYMORIAL SUR IN A	ef doed ef doed	122	15, CONTYNIC MC[46-1	IJTRAJ	59
	ng 310 [9=1,1]	FLSOFY	124	BELION	TJTRAJ	70
	T;=T2-AL+S1(IP,2)-9T+S1(IP,1) T2=S1(IP,2)	FLEGFY	125	¢	LASTLI	71
	21(14,1)=21(14,2)	FLSOFY	126	END	IJTRAJ	72 73
	\$1(T4,2) = \$1	FESSEY	127		191443	73
3 2	, A[[4]+A[[4]+7]+S][[4],5]	FLSOFY	12*			
	- 164 · C	EF 43EA	129			
9	S DETIJON	FL TOFY	130			
91				SURBOUTTHE INSUIT	THEUT	,
91	S DETIJON	FL TOFY	130	C CREDUILINE IMENIA	THPUT IMPUT	2
gı	S DETIJON	FL TOFY	130	C THIS ROUTING READS ALL DATA REQUIRED FOR ONE CASE,	IMPUT IMPUT	2
91	S DETIJON	FL TOFY	130	C THIS ROUTINE READS ALL DATA PEOUIRED FOR ONE CASE, C EYCEPT FLOW FEELD DATA FOR RERUN	THPUT THPUT THPUT	2 2 4
91	; og Tijo v Emg	ef2deA Ef4deA	196 191	C THIS ROUTING READS ALL DATA REQUIRED FOR ONE CASE, C EYCEPT FLOW FEELD DATA FOR RERUM C	IMPUT IMPUT IMPUT IMPUT	2 2 4 4 6 6
g.	S DETIJON	ITATI EF20EA EF40EA	130	C THIS ROUTINE READS ALL DATA REQUIRED FOR THE CASE, C EYCEPT FLOW FIELD DATA FOR REBUN C COMMON FATHY ANGREAGNERS (REDUN SCON (20)	INPUT INPUT INPUT INPUT ATH	2 2 4 # 6
c	CANDILLIANE TILESTEEN AND TO THE TOP AND THE TREE TO THE CONTRACTOR OF THE CONTRACTO	ef2deA Ef4deA	196 191	C THIS ROUTINE READS ALL DATA PEOUIRED FOR ONE CASE, C EVCEPT FLOW FEELD DATA FOR RERUM C COMMON FATHY ANGPRANGURECOMPSCON(20) COMMON/COMITIANAXKMAXJUREN, KROMPSCON(20)	THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT THPUT	2 2 4 # 6 9 9 9
ç c c	; og Tijo v Emg	PADE JE PADE J	130 131 2 2	C THIS ROUTING PEADS ALL DATA PEOUIRED FOR ONE CASE, C EVCEPT FLOW FIELD DATA FOR RERUM C COMMON FATHY ANGPLANGH, KRCOM, SCON(20) FORMON/COMIJANAY KRAXS JH, KM, XMACCJALUMA, GAM-CAMMIL, CH, PT, S MIS, IPRT, P CHOPO, NCA, NCS, NCC, ALD, NC DEGA, MUJ, MUL, ST, YAN, ITEO, FMT, PTORT, PIMF,	INPUT INPUT INPUT INPUT ATH	2 2 4 4 6 2 7 7 4
c c	SPINON CHOOL CHOOL CALL CONTROL CONTRO	VACCJA VACCJA LAPTLI LAPTLI LAPTLI LAPTLI LAPTLI	190 191 2 2 2 4	C THIS ROUTING PEADS ALL DATA PEOUIRED FOR ONE CASE, C EVCEPT FLOW FIELD DATA FOR RERUM C COMMON /ATM/ ANGP, ANGH, KRCOM, SCON(20) FORMON/FORE/JAMAY, KRAEN JH, KM, KMACA (J. ALBHA, GAM, GAMHI, CM, PT, SMI), FORT, FORMON/FORE/JAMAY, KRAEN JH, KM, KMACA (J. ALBHA, GAM, GAMHI, CM, PT, SMI), FORT, FORMON/FORE/JAMAY, COURS, JH, MORN, PMOSE, MCASE, NPUNCH FORMON/FORE/SON(20), KORON, SCON(20)	CUMI CUMI CUMI CUMI CUMI CUMI CUMI CUMI	2 2 4 4 6 6 7 7 7 4 2
c c c c c	CHD  CURBOUTTNE IITRAJEXP, YP, IT, JT, OT, QJ, YFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN	FL COFY FL COFY I LAPTLI LAPTLI LAPTLI LAPTLI LAPTLI LAPTLI	190 191 2 2 4 5 6 7	C THIS ROUTTHE BEADS ALL DATA PEOUIRED FOR ONE CASE, C EYCEPT FLOW FIELD DATA FOR REBUM C COMMON FATH/ ANGP, ANGN, KRCON, SCON(20) COMMON FATH/ ANGP, ANGN, KRACON, SCON(20) COMMON FORE, NCS, AS, MORROGA, MU, MU, ATT, TAU, TITES, FAT, PTORT, PINF,  **INF, OTNE, CINF, ACS, TH, COUS, PT, MORN, PMOSE, MCASE, NPUMCH FORMON FOLMT/ KYCON, YCON(20), KYCON, SCON(2), COMMON FALUNT/ THETA(25), PT, PC20, 25), MALLINT	IMPUT THPUT THPUT THPUT ATH COME COME COME TUMT	2 3 4 4 6 2 7 7 4 2 2 2
c c c	SETION CHOOL CHOOL CARRY CARRANGE (XP, YP)	LT447 LT447 LT447 LT447 LT447 LT447 LT447 LT447 LT447	190 191 2 2 4 5 6	C THIS ROUTING READS ALL DATA PROUIRED FOR THE CASE, C EVERT FLOW FIELD DATA FOR RERUM  COMMON JATHY ANGPLANGH, KRCOM, SCON(29) PORMON/FORIJARA, KRAEL JH, KR., KRACJALDHA, GAM, GAMMI, CH, PT, SMI), IPRT, POMON, NCALANES, NCCAL, ALH, DORGA, MUI, MLLIT, TAI), ITEO, FHT, PTORT, PINF,  KIMEN, OTHE, COMEN, KOOKED, SHE, MORN, PHOTE, MARKATE, NPUNCH FORMON JOONT/ KOOM, WOOKED, SKEPCH, SECON(2:) COMMON JONSTRAY, PROTA, TENDER TORMON JONSTRAY, PROTA, TENDER TORMON JONSTRAY, PROTA, TENDER TORMON JONSTRAY, PROTA, TENDER, NEADO, NEADO, NEADO, NEADO, TORMON	IMPUT TMPUT TMPUT IMPUT MTML COME COME COME COME COME OME OME OME OME OME OME OME OME OME	234 # 622 7
c c c c c	CUMBOUTTHE IJTERACEXP, YP, IT, JT, OI, OJ, MFLAG)  THIS SUSROUTINE LOCATER A TRAJECTORY POINT IN  THE COMPUTATIONAL GRID  IT, JT IS LOWER LEFT CORMER OF GPID SECTION CONTAINING (XP, YP)  COMMON FALUNTY THETA(25), PP(22), 251, MBLIUNT	VACSTA VACSTA LAPTE LAPTE LAPTE LAPTE LAPTE LAPTE LAPTE LAPTE LAPTE LAPTE LAPTE	130 131 2 2 4 5 6 7 8	C THIS ROUTINE READS ALL DATA REQUIRED FOR THE CASE, C EVCEPT FLOW FIELD DATA FOR REBUN C COMMON FRENCH FRENCH C COMMON FRENCH FRENCH > CHARON, DATA NEON BOCK, ASH, DATA FOR BOCK, ASH, DEST, PEOF, PEOF, SHIP, FORT, PINF,  «TIME, OTHE, FLOS, TH, CLUS, PT, DORN, PHOSE, MCASE, NPUNCH COMMON FRENCH FRENCH FRENCH FRENCH, RECORD, AVECUATION TORMON FRENCH FRENCH FRENCH FRENCH FRENCH FRENCH TORMON FRENCH F	IMPUT IMPUT IMPUT IMPUT IMPUT COMI COMI COMI PLUNT DNSTRH JOE	294562277
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c c c c c	COMMON YALUMTY THERESSES OF TOPING OF THE CONTAINING (XP, YP)  COMMON THE CONTROL OF TOPING OF GPIO SECTION CONTAINING (XP, YP)  COMMON TALUMTY THERE(25), PP(2), 25), NACION COMMON TANUMSY XADD(10C), YADD(10C), XAMY(10C), YSHY(10C),  **NAMES NAMES ARACH, CAMBA, PROS, WHINT	FL SOFY  TJTRAJ TJTRAJ TJTRAJ TJTRAJ TJTRAJ TJTRAJ TJTRAJ TJTRAJ TJTRAJ	2 2 2 5 6 7 8 7 7 8 7 7 8 7 7 8 7 7 7 8 7 7 7 7	C THIS ROUTINE BEADS ALL DATA PEOUIRED FOR ONE CASE, EVCEPT FLOW FEELD DATA FOR REBUM  C COMMON JATH/ ANGP, ANGR, KRCOM, SCON(20) COMMON(TOMI, JAMAY, KAMAY, JH, KM, XMAC4, JALEMA, GAM, CAMMI, CM, DT, SMI, LORT, COMMON JONE, NOS, MCC, AA, H, ONEGA, MU, MU, SIT, YAU, ITEO, FMT, PTORT, PIMF, EMM, OTHER, CIMP, JCGS, TH, CUCUS, PT, HORD, MONTE, MCASE, NPUNCH COMMON JCDMTY, KYCOM, VCOM(20), KYCOM, RCOM(2), COMMON JONETHY, PPLOTA JEMO, NYADO, HYCOLT COMMON JONETHY, PPLOTA JEMO, NYADO, HYCOTA COMMON JONETHY, CEP, JCF, JTF, ZTEAN, DZTEAN LOGICAL LGB AV COMMON/MADOD/KXIJJDI-YY(10.), PMBOD, LORAV	IMPUT IMPUT IMPUT IMPUT IMPUT CONT CONT CONT ONSTRH JOE MUROD WIROD	234 # 6 2 2 7 4 2 2 2 2 2 3 9
c c c c c	COMMON AND AND SECURED STANDARD STANDAR	FL COFY FL SOFY I JTRAJ I JTRAJ I JTRAJ I JTRAJ I JTRAJ RLIMIT 8 DLIMIT 8 DLIMIT 8 DLIMOS DRO DRO DRO	136 131 2 2 4 5 6 7 8 2 2 3	C THIS ROUTING BEADS ALL DATA PROUIRED FOR THE CASE, C EVCEPT FLOW FIELD DATA FOR RERUM  COMMON JATHY ANGP, ANGH, KRCOM, SCOW(29) COMMON/COMIJAMA, KRAEL, JY, KN., KMACA, ALDMA, GAM, GAMMI, CM, DT, SMI, IPRT, CHMON, HCA, NCS, KKAEL, JY, KN., KMACA, ALDMA, GAM, GAMMI, CM, DT, SMI, IPRT, CHMON, COMIJAKO, ANGHO (20), KMRCOM, SCOW(2), COMMON JOUNT, KUROM, VCOW(20), KMRCOM, SCOW(2), COMMON JONISMAY, PROOF, KMRCOM, STADO, MYSOLOT COMMON JONISMAY, PROOF, KMRCOM, STADO, MYSOLOT COMMON JONISMAY, DECTION, STADO, MYSOLOT COMMON JOET JULI, CEI, CF2, ZLF, ZTRAN, DZTPAN LOGICAL LGBAY	IMPUT TMPUT TMPUT IMPUT IMPUT OPEL CONT OLUNT OVSTER JOE NUMPOO	2 7 4 7 6 7 7 7 4 22 7 2 2 3 2 5
c c c c c	CHOOLERS (SETION CHOOLERS A TRAJECTORY POINT IN THE COMPUTATIONAL GRID  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRID  IT, JI IS LOWER LEFT CORMER OF GPIO SECTION CONTAINING (XP, YP)  COMMON (AGUNTY THISTA(25), PP(12), 25), NALIUNT COPMON (AGUNTY XADDIJOE), YADDILOCH, XEVE (10)), YSHF(100),  WHEAT, NXMAX, AMACH, CAMMA, MEO, NHINCX LEVEL 2, AMGO NITH, DEG	FL COFY FL SOFY IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ SOLIMOS DRO DRO DRO DRO DRO	130 131 2 2 4 6 7 8 7 8 2 3 2 3 2	C THIS ROUTINE BEADS ALL DATA PEOUIRED FOR THE CASE, C EVCENT FLOW FIELD DATA FOR RERUM  C COMMON JATAY ANGRANGH, RACON-BECOM(20)  COMMON JATAY ANGRANDAM, RAY, JAM, KA, XMAC+JALDHA, GAM-SAMHI, CM, DT, SMI, IPRT,  MORO, NCA-NC3, NCC, AR, MODREGA, MU, NL, TT, TAN, TTSO, FMT, PTORT, PINF,  CHAR, OTHER, CONT, KCOMA, VCON(20), XCOCN, RECON(2:)  COMMON JOET/ KCOMA, VCON(20), XCOCN, RECON(2:)  TOMMON JOET/ KCOMA, VCON(20), XCOCN, RECON(2:)  TOMMON JOET/ KLOOP, VCON(20), XCOCN, RECON(2:)  LOGICAL LGBAV  COMMON JONES/ TROOLDON, TONEON, LGRAV  COMMON JONES/ TROOLDON, TROOLDON, LGRAV  COMMON JONES/ TROOLDON, TROOLDON, TROM  MERCY, BYMAC, TROOLDON, TROOLDON, TROOLDON, TROM  LOGICAL LERGUN, PREFLOREST, LEPPON, LIPPA, PROTITINEDAM, LRSTRY	IMPUT IMPUT IMPUT IMPUT ATM COME COME COME COME COME DUSTRA JUE NUMBOD WISHOD BIUMOS	274 . 6 2 7 7 4 2 2 7 2 2 3 2 3 2 3 2
000000	COMMON ARROYS CONTROL OF ARTHUR CONTROL OF ARTHUR COMMON ARROYS COMMON A	FL COFY  IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ IJTRAJ ROMINOS ORN ORN ORN TJTRAJ	190 191 2 2 2 4 5 6 7 6 7 6 7 8 2 2 2 2 2 3 2 2 3 2 2 3 2 2 3 2 3 2 3	C THIS ROUTINE READS ALL DATA PEOUIRED FOR THE CASE, C C C CHANGA /ATM/ ANGP, ANGH, KRCOM, SCON(20) COMMON/COMIJANING KRAKAN, JM, KM, KMACA JALOMA, GAMMS CAMMI, CM, DT, SMID, IRRT, CHORO, ROLANGS, MCCO, ASH, GOMEGA, MU, ML, STT, TAID, TTEO, FMT, PTORT, PIME, CIMES, OTME, COME, ACCOMEGA, MU, GHO, ST, MCASE, NPUMCH COMMON /COMY/ KOCOM, VCOMEGA, SECON, SECON, SECON, COMECON (20) COMMON /SCUMP/ FOR COMP, VCOMEGA, SECON, SECON, SECON, TOT, OMMON /OMSTRAY, PROLOTA, PERON, NEADO, ANGLO,	IMPUT IMPUT IMPUT IMPUT IMPUT CONI CONI CONI CONT OMSTRM JOE MURODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRODO WIRO	234 . 627 74 22 72 23 23 23 23 23 23
	COMMON AND AND SECURED STANDARD STANDAR	FL COFY FL SOFY I JTRAJ I JTRAJ I JTRAJ I JTRAJ I JTRAJ I JTRAJ SQUMOS DRO DRO DRO DRO TJTRAJ TJTRAJ	136 131 2 2 2 4 6 7 8 7 8 2 3 2 13 14	C THIS ROUTINE BEADS ALL DATA PEOUIRED FOR THE CASE, EVCENT FLOW FIELD DATA FOR REBUM  C COMMON JATHA ANGRANGH, RECOMBECON(20)  COMMON JATHA ANGRANGH, RECOMBECAL HALL HALL HALL HALL HALL HALL HALL H	IMPUT IMPUT IMPUT IMPUT IMPUT IMPUT COMI COMI COMI COMI FOUNT PLUMT PUSTER MUSHOD BOUNDS PROPET PROPET PROPET	274 * 627 7 4 2 2 7 2 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3
000000	CUMPONITINE IITRAJ(XP,YP,IT,JT,OT,OJ,MFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRID  IT,JT IS LOWER LEFT CORNER OF GPIO SECTION CONTAINING (XP,YP)  COMMON /ANUNOS/ XADDIALO/YMPOLICALO/YMY(107),YSHK(106),  HORATO NAKAS,ARACH,SCAMAS,HOC,MHINTX LEVEL 2, ARGONTH.DEG COMPON /ARGONTH.DEG COMPON /ARGONTH.DEG COMPON /ARGONTH.DEG COMPON /FLOW/ KC(ZJ,JDG), PXTH(1CJ), PEG CORNEN /FLOW/ KC(ZJ,JDG), PXTH(1CJ), PEG CORNEN /FLOW/ KC(ZJ,JDG), PY(ZJ,JDG), FY(ZC,JDG), RHOF(ZD,JTG)	FL COFY FL SOFY I JTRAJ I JTRAJ I JTRAJ I JTRAJ I JTRAJ I JTRAJ I JTRAJ ROMINOS DRO DRO DRO DRO DRO DRO DRO JTRAJ I JTRAJ	196 191 2 2 2 4 5 6 7 6 7 8 2 2 2 2 3 2 1 3 1 1 1 1 1 1 1 1 1 1 1 1	C THIS ROUTINE READS ALL DATA PEOUIRED FOR THE CASE,  C C C C C C C C C C C C C C C C C C	IMPUT TMPUT TMPUT IMPUT IMPUT COME COME COME COME COME COME COME MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER MUSTER	234 5627 74 22 72 23 23 23 23 23 23 23 23 23 23 23 23 23
	CURROLITINE IITRAJ(XP,YP,IT,JT,OI,QJ,4FLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRID  IT,JT IS LOWER LEFT CORMER OF GPIO SECTION CONTAINING (XP,YP)  COMMON (AGUNT) THETA(25),PP(22),25),NALIUNT COMMON (AGUNTS) XADDIJG(),YADGIJG(),XANG(101),YSHF(100),  EMPLE, NKRAKZARACH,GAMRA,MBG,NMINCX LEVEL 2, ANGONITH-DEG COMPON JORD/ ANG(20,100),YT(2),JOC),YF(20,100),RHOF(20,110)  POINT IS IN POLAR COORDINATE PEGTON  IF (Y*,GE,GA) GO TO SO	FLOGFY  LITEAL	130 131 2 2 2 4 5 6 7 6 7 7 8 7 2 13 12 15 15 15	C THIS ROUTINE BEADS ALL DATA PEOUIRED FOR THE CASE, C EVCENT FLOW FIELD DATA FOR REBUM  C COMMON JATHY ANDRIANGH, RECOM-SCON(22)  COMMON JOTHY, ANDRIANGH, REAL STRING, ALDMA, GAMM, GAMMI, CM, DT, SMI, IPRT, COMMON JOHN, PINS, COME, AB, M, DMEGA, MU, ML, JT, TAY, ITES, FMT, PTORT, PINS, GEMM, OTHER, JCS, TM, CLUS, PT, HORM, PUNCKEY.)  COMMON JOHN, JCS, TM, CLUS, PT, HORM, PUNCKEY.)  COMMON JOHTHY, THETA(25), PP(20, 25), WHINT COMMON JOHTHY, PYOLO, MEMON, PRODE, MY SUCHT COMMON JOHTHY, PYOLO, THE THE JOHN DEAL STRING, THEAM LOGICAL GEAW COMMON JOHN STRING, PRODE, STRING, PRODE, STRING, POMMON JOHN STRING, PRODUCTION, PRODUC	IMPUT IMPUT IMPUT IMPUT IMPUT IMPUT COME COME COME COME COME MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSAND MUSA	274 * 6 ? ? 7 4 2 2 ? 2 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3
	CURROLITINE IITRAJ(XP,YP,IT,JT,OI,QJ,4FLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRID  IT,JI IS LOWER LEFT CORMER OF GPID SECTION CONTAINING (XP,YP)  COMMON /AGUNT/ THISTA(25),PP(22),25),NALINT COPMON /AGUNT/ THISTA(25),PP(22),XPN,XPN(100),YSNF(100),  EVEL 2, ANGO NITH,DEG COMPON /ORD/ ANG(23),103),PXT4(103),PEG COMPON /FLOW/ KC(23),103),PXT4(103),PEG COMPON /FLOW/ KC(23),103),PXT(23),JP(22,JD),RHOF(23,IF)  **NAT IS IN POLAR COORDINATE PEGION  IF (YP oE. 3.61) GO TO 50  THIS ATANZ(YP, -YP)FORE **SOMT(YPOP-24)PP(20)	FL SOFY  I JTTRA J 1 JTTRA	136 131 2 2 2 3 6 7 6 7 6 7 7 8 2 13 14 15 16 17	C THIS ROUTINE READS ALL DATA PEOUIRED FOR THE CASE,  C C CHAPM /ATM / ANGP, ANGM, KRCOM, SCOM(20)  COMMON /ATM / ANGP, ANGM, KRCOM, SCOM(20)  COMMON /COMI, KRAEL, JH, KM, KMACAJ, ALDMA, GAMM, CAMMI, CM, DT, SMID, IPRT,  FOMEO, NCA, NCS, KMAC, JH, KMACAJ, ALDMA, GAM, SCAMMI, CM, DT, SMID, IPRT,  CHAPO, NCAMY, KCOCO, SCOM(20)  COMMON /COMY / KCOCO, KMCOM(20)  COMMON /MONTRM, PROTO, TARGED, KMCOM, SCOM, COLOR  COMMON /MONTRM, PROTO, TARGED, KMCOM, SCOM,  COMMON /MONTRM, PROTO, TARGED, TRAN, DITDAM  LOGICAL LGBAY  COMMON /MONDSY / MODOLOSADO, MODOLOSADY  COMMON /MODOLOSADO, MODOLOSADO, MODOLOSADY  COMMON /MODOLOSADO, MODOLOSADO, MODOLOSADO  COMMON /MODOLOSADO, MODOLOSADO, MODOLOSADO  COMMON /MODOLOSADO, MODOLOSADO  COMMON /MODOLOSADO, MODOLOSADO  COMMON /MODOLOSADO  ATRAICICO) / MODOLOSADO  ***TRAICICO) / M	IMPUT IMPUT IMPUT IMPUT IMPUT ATM COMI COMI COMI COMI COMI PUMT PUMT MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MIS	274 - 627 - 427 - 722 - 723 - 23 - 23 - 23 - 23 - 23
	CUMPONITINE ISTRACTORY, YP, IT, ST, OI, OJ, MFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRID  IT, ST IS LOWER LEFT CORMER OF GPID SECTION CONTAINING (XP, YP)  COMMON FALUNDS, MADDISACL, YAROLISACL, XCMM(1001), YSMM(1001), WHERE, NEWAS, ARACM, GAMRALMO, MMINEX LEMEL S. ARGENETH, DEG COMMON FALUND KC(2), SDDI, PETALOLISACL, YEAR COMMON FALUND KC(2), SDDI, PETALOLISACL, YEAR  POINT (S IM POLAR COGROTHATE REGTOM  IF (YP. GE. 3.66) SO TO SO THISACTARY (YP, -FEDROGE WES GRITTPOR CARPORES) TO 11. JEZYSBLUNT	FLOSFY  LITERAL	196 191 2 2 2 4 7 6 7 7 8 7 2 3 2 15 14 14 15 16 17 19	C THIS ROUTINE READS ALL DATA PROUIRED FOR THE CASE,  C EVCEPT FLOW FIELD DATA FOR RERUM  C CHMMM YATMY ANGP, ANGM, KRCOM, SCOM(29)  COMMON YATMY ANGP, ANGM, KRCOM, SCOM(29)  COMMON YATMY ANGP, ANGM, KRACA, JM, KM, XMAC4, ALDMA, GAM, SCAMMI, CM, DT, SMM, FORT, POMON, MCOKECO, AM, MODRES, MM, ML, ST, TAN, STES, FMT, FTORT, PIME,  COMMON YALUMTY THETA(25), PP(20, 25), VMELUMT  COMMON YALUMTY THETA(25), VMENO, LOPAN  COMMON YANGADAY THOO STORY THE THAT THAT	IMPUT IMPUT IMPUT IMPUT AIM CONT CONT CONT CONT CONT OVSTRM JOE NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS NUMOS Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Numos Nu	294 - 627 74 27 72 23 23 23 25 47 27
000000	THE SUPPORTING ELECTRON OF THE SUPPORT OF THE SUPPO	FL SOFY  I JTTRA J 1 JTTRA	136 131 2 2 2 3 6 7 6 7 8 2 3 2 13 15 16 17 18 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19	C THIS ROUTINE READS ALL DATA PEOUIRED FOR THE CASE, C EVCENT FLOW FIELD DATA FOR REBUM  C CHMMM JATMY ANDR-ANDR-KROUN-SCON(29)  C CHMMM JATMY ANDR-ANDR-KROUN-SCON(29)  C CHMMM JOHN-CINE, COS, THE CULS, WINGERS HAVE ALD HARDS HAVE FORT, PTORT, PIME, ASTME, OTHER, FIRE, LOSS, THE CULS, PT, HORDE, PMANTS, MCASE, MPUNCH COMMON JOHN-CONTY, KYCON, YCON(20), KPCOH, RCON(2).  COMMON JOHN-CHAPT, METALESS, PPREDE 251, WALLINT CHMMM JOHN-TRAY, PTOLOF, MEMBER, MEADON HAVELOT CHMMM JOHN-TRAY, PTOLOF, MEMBER, MEMBER LOGICAL LOGAW COMMON JOHN-KROUND HAVELOT COMMON JOHN	IMPUT IMPUT IMPUT IMPUT IMPUT ATM COMI COMI COMI COMI COMI PUMT PUMT MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MISMOD MIS	2744.67774227232323254522
000000	CUMPONITINE ISTRACTIVE, YP, IT, ST, OI, OJ, MFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRIO  IT, ST IS LOWER LEFT CORNER OF GPID SECTION CONTAINING (XP, YP)  COMPON MANUNOS, MADDISACINA ANDOLISALINAT COMPON MANUNOS, MADDISACINA ANDOLISALINAT LEVEL 28, ANGENTHASES COMPON MATOR AND	FLOSFY  LITERAL	136 131 2 2 2 4 5 6 7 6 7 7 2 3 2 3 2 15 16 17 19 19 19 2 19 19 19 19 19 19 19 19 19 19 19 19 19	C THIS ROUTINE BEADS ALL DATA PEOUIRED SIP THE CASE,  C EVCEPT FLOW FIELD DATA FIR RERUM  C CHMINN JETMY ANGP, ANGN, KRCON, SCOUL(2))  COMMINN JETMY ANGP, ANGN, KRCON, SCOUL(2))  COMMINN JETMY, ANGR, ANGN, KRACH, JETMY, TAW, TTES, FMT, FTORT, PIME,  CHME, OTME, CLOKE, ALL, DORGE, MU, ML, ST, TAW, TTES, FMT, FTORT, PIME,  COMMIN JECTY KOORN, VCONICO, SKEPCH, SECONICE:)  COMMIN JOHNTHY, THETAL231, PP(20, 221, WALLINT  COMMINN JOETZIL, CET, CEF, ZIF, ZTRAM, DITEMN  LOGICAL LGBAY  COMMINN JOETZIL, CET, CEF, ZIF, ZTRAM, DITEMN  LOGICAL LGBAY  COMMINN JOETZIL, CHICES, ZIF, ZTRAM, DITEMN  LOGICAL LGBAY, MADONIC, SHOW, STRAM, DITEMN  LOGICAL LGBAY, MATEMALIZAL, PRESTILERCHM, LPRR, PLOTILITAL, LRSTOT  COMMINN JOEDZIT JOETZILOO, STRAMICON, STRAMICO), STRAMICO), STRAMICO),  WITCHILOS), VETRAMICON, STRAMICON, STRAMICO), STRAMICO), STRAMICO), STRAMICO),  TOMMINN JOEDZIT JOHANKT, MARKT(12)  LOGICAL LEDIN  LOGICAL LEDIN  LOGICAL LEDIN  LOGICAL LEDIN  LOGICAL LEDIN	THUIT	27456777422722727272727272727272727272727272
c c c c c c c c c c c c c c c c c c c	TURBOUTTNE IJTRAJ(XP,YP,IT,JT,OI,QJ,4FLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMMUTATIONAL GRID  IT,JT IS LOWER LEFT CORMER OF GPIO SECTION CONTAINING (XP,YP)  COMMUN FALUNT, THETA(25),PP(22),25),NALINAT COMMUN FALUNT, THETA(25),PP(22),55),NALINAT COMMUN FALUNT, THETA(25),PP(23),FR(107),YSHF(107),  **MOPAY,NXRAX,ARACH,GAMRA,MRG,NHINEX LEVEL 2, ANG.DXTHA,DEG COMMUN FORD, ANG(23),107,PXT4(114),PEG COMMUN FORD, ANG(23),107,PXT4(114),PEG COMMUN FLOWY RE(23),101,PY(23),130),WF(27,130),RHOF(20,110)  **OTHET IS IN POLAR COORDINATE PEGTON  IF (YP .GE. 3.6) SO TO SO THEAATANZ(YP,-TRIBOEG **SOFT(TYPE-24)PPROEC **SOFT(TYPE-24)PROEC **SOFT(TYPE-24)PROEC **SOFT(TYPE-24)PROEC **SOFT(TYPE-24)PROEC) **OTHETHIS .GT. THEAD GO TO 25 J. CONTINUE **SOFT(TATALE) .GT. THEAD GO TO 25 JOINTINIE **SOFT(TATALE) .GT. THEAD GO TO 25 JOINT T	FL SOFY  I JTTRA J 1 JTTRA	136 131 2 2 2 3 6 7 6 7 6 7 2 13 15 16 17 19 19 19 19 19 19 19 19 19 19 19 19 19	C THIS ROUTINE READS ALL DATA PEOUIRED COP ONE CASE, EVCENT FLOW FIELD DATA FOR REBUM  C COMMON SATMS ANDRAMOR, RECOMBERCATE OF THE CASE, COMMON SATMS ANDRAMOREDAMM, MASTET TAMISTED, FMT, PTORT, PIME, COMMON STOME, THE CASE, THE CUES, PT, MOREN PROTES, MCASE, MPUNCH COMMON SCLUMTY KYCOM SYCOMEZOD, REPCHA RECOMEZO, COMMON SCLUMTY KYCOM SYCOMEZOD, REPCHA RECOMEZO COMMON SALUMT STEETASES, PRESENTABLINT COMMON SALUMT STEETASES, PRESENTABLINDS, STEETAS COMMON SALUMT STEETASES, PRESENTABLINDS, STEETAS COMMON SPECIAL STEETAS COMMON STEED STEETAS COMMON STEETAS COMMON STEETAS COMMON STEED STEETAS COMMON STEETAS	THEORY TRANST THEORY THEORY THEORY TO THE COUNT COUNT OUTSTREE JOE ROUNT PROPT TRANST	27.44.6977442272232323234722723
c c c c c c c c c c c c c c c c c c c	CUMBOUITINE IJTRAJ(XP,YP,IT,JT,OT,OJ,MFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRIO  IT,JT IS LOWER LEFT COBMER OF GPIO SECTION CONTAINING (XP,YP)  COMMON FALUMIT/ THETA(25),PP(22),25),AMILIMIT COMMON FAUNDAY, AMDOLIACI,DYMODICIOL,NEWR(100),YSMF(100),  **MEMBAY,NXMAX,AMACM,GAMMA,MHO,MHINCX LEVEL 29, ANGENTH,DEG COMMON FALUMY KC(23),1001, YT(2),1301,VF(2C,130),RMDF(20,100)  **ONINT (S IN POLAR COGROUNATE PEGTOM  IF (YP,GE,GG,GG,GG,GG,GG,GG,GG,GG,GG,GG,GG,GG,	FLOSFY  LITERAL	136 137 2 2 2 4 5 6 7 6 7 7 2 3 2 3 2 3 15 11 11 11 11 11 11 11 11 11 11 11 11	C THIS ROUTINE BEADS ALL DATA PEOUIRED STR THE CASE,  C EVCEPT FLOW FIELD DATA FOR RERUM  COMMON / STMY AMGS, AMGN, RECOM, SCOV(29)  COMMON / STMY AMGS, AMGN, RECOM, SCOV(29)  COMMON / STMY AMGS, AMGN, RECOM, SCOV(29)  COMMON / STMY / SCOV, AMGNOREGA, MU, ML, IT, TAN, ITSO, FMT, FTORT, FIME,  **IME, OTMES, CIME, JCS, IT, CLUS, PT, MORN, BMOSC, RCASE, NPUMCH  TOMMON / SCONT / KCOM, **VOOK(20) AS PCON, SCOV(2).  COMMON / SCONT / KCOM, **VOOK(20) AS PCON, SCOV(2).  TOMMON / JOH TAY / TOLT, TERE NO, TOLD AND AND AND AND AND AND AND AND AND AN	THUIT	232525254527254
c c c c c c c c c c c c c c c c c c c	THE SUPROUTINE LITERAL(XP, YP, LT, JT, OI, OJ, WFLAG)  THIS SUPROUTINE LOCATES A TRAJECTORY POINT IN THE COMMUTATIONAL GRID  LT, JT IS LOWER LEFT CORNER OF GPIO SECTION CONTAINING (XP, YP)  COMMUN FALUNTY THETAL(25), PPE(22), 25), WALHINT COMMUN FALUNTY THETAL(25), PPE(22), X5), WALHINT COMMUN FALUNTY THETAL(25), PPE(22), X45, NYAMINEX LEVEL 2, AMG, NYAMIN, DEG COMMUN FORDY ANG(23), LOTY ALL (143), PEG COMMUN FORDY ANG COORDINATE PEGTON  IF (YP, CE, 3, G) GO TO SO THITALATANZ(YP, THEOREG DAS QUETYPOPO 24, PPOPOLO 1, JANASUNT 1, (THETALA), CT. THITA) GD TO 25 JANASUNT JANASUNT 2, JELJAN 3, CONTINUE JANASUNT 1, JELJAN 1, JEL	FL SOFY  I JTTRA J 1 JTTRA	136 131 2 2 2 3 6 7 6 7 6 7 2 13 15 16 17 19 19 19 19 19 19 19 19 19 19 19 19 19	C THIS ROUTINE READS ALL DATA PEOUIRED COR ONE CASE, EVCENT FLOW FIELD DATA FOR REBUM  C COMMON SATMS ANDRAMOR, RECOMBERCALED AND CAMMING AND SAME SAME, THE SAME SAME SAME SAME SAME SAME SAME SAM	THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT COUNT COUNT COUNT COUNT OUTSTREE JUSE JUSE JUSE JUSE JUSE JUSE JUSE JU	2325252525452232346
c c c c c c c c c c c c c c c c c c c	CURROUTTINE IITRAJ(XP,YP,IT,JT,OT,OJ,MFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRIO  IT,JT IS LOWER LEFT FORMER OF GPIO SECTION CONTAINING (XP,YP)  COMMON ADUNDS, YADOLIGLE YADOLIGLE, YEMM(1007), YSHK(1007),  * Nemathintral, arach, Gamma, Hed, NHINCX LEVEL 2, ARG, DXTH,DEG COMMON JORD, ARG(23,103), DXT4(1CG),PEC COMMON JORD, ARG(23,103), TXT4(1CG),PEC COMMON JORD, ARG(23,103), TXT4(1CG), TXTALICAL COMMON JORD, ARG(23,103), TXTALICAL COMMON JORD, ARG(23,103), TXTALICAL COMMON JORD, ARG(23,103), TXTALICAL COMMON	FL COFY FL COF	136 131 2 2 2 3 6 7 6 7 6 7 8 2 13 15 16 17 19 20 21 22 23 24 25 26 27 27 27 27 27 27 27 27 27 27 27 27 27	C THIS ROUTINE BEADS ALL DATA PROUIRED TOP THE CASE,  C EVCEPT FLOW FIELD DATA FOR RERUM  COMMON JATHY ANGRANDAM, RACCOM-SCOVICED  COMMON JATHY ANGRANDAM, WANGEGA. MU, ML, IT, TAN, ITES, FAT, PTORT, PIME,  CHERO, NCA, NCS, NCC, AA, MODREGA. MU, ML, IT, TAN, ITES, FAT, PTORT, PIME,  CHERO, THE CONTY KOORN, YCONICO, SAKEON, ROCKET.  COMMON JONSTRAY, POLOT, MEROM, NEADO, NVALOR  TOMMON JONSTRAY, POLOT, MEROM, NEADO, NVALOR  COMMON JONSTRAY, POLOT, NEADO, NVALOR  COMMON JONSTRAY, POLOT, NEADO, NVALOR  COMMON JONSTRAY, POLOT, NEADO, NEADO, LORAV  COMMON JONSTRAY, POLOT, NEADO, LORAV  COMMON JONSTRAY, POLOT, NEADO, LORAV  COMMON JONSTRAY, POLOT, NEADO, LORAV  COMMON JONGTRAY, NATOLIZODA, NEADO, LORAV  COMMON JONGTRAY, NATOLIZODA, NEADO, JONGTRAY  LOGICAL LEEQUUM, PREFLA, PERSTA, PROCING, PRA, PLOTALIZAJLESTOT  COMMON JONGTRAY, NATOLIZODA, NATOLIZODA, NATOLIZODA, NATOLIZODA, NATOLIZODA,  **TRAJICODA, NATOLIZODA, NATOLIZODA, NATOLIZODA, NATOLIZODA,  **TRAJICODA, NATOLIZODA, NATOLIZODA, NATOLIZODA, NATOLIZODA,  **TRAJICODA, NATOLIZODA, NATOLIZODA, NATOLIZODA,  COMMON JONGTRA, NATOLIZODA, NATOLIZODA,  COMMON JONGTRA, NATOLIZODA, NATOLIZODA,  **TRAJICODA, NATOLIZODA, NATOLIZODA, NATOLIZODA,  COMMON JONGTRA, NATOLIZODA,  **TRAJICODA, NATOLIZODA,  **TRAJICODA,  **TRAJI	THENT TRUNKTHENT TRUNKTH	232323272727274627
c c c c c c c c c c c c c c c c c c c	TURBOUTTNE IJTRAJ(XP,YP,IT,JT,OT,OJ,MFLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRIO  IT,JT IS LOWER LEFT CORMER OF GPID SECTION CONTAINING (XP,YP)  COMMON ADMINDS (XMODIJOLDYMODIGOL), XENT(100), YSHF(100),  * Neparankmax,amach,Gamma, Hed, Netherlad), YSHF(100), YSHF(100),  COMMON JORD / ANGIZJ,JDJ,DXT4(101),PER  COMMON JORD / ANGIZJ,JDJ,DXT4(101),PER  COMMON JORD / ANGIZJ,JDJ,DXT4(101),PER  ONINI IS IN POLAR COGRDINATE PEGTON  IF (YP,GE,GL,GL) TO SE  THISALTAMZ(YP,-YP)****DECE  ### SEC. GL,GL,GL) TO TO SE  THISALTAMZ(YP,-YP)************************************	FICORY  LITERAL LITERA	190 191 2 2 4 5 6 7 8 7 2 3 2 3 2 3 1 1 1 1 7 2 2 4 5 6 7 1 1 1 1 7 2 2 2 4 5 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 2 6 7 2 2 6 7 2 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2 6 7 2 2	C THIS ROUTINE BEADS ALL DATA PROUIRED FOR THE CASE,  C EVCEPT FLOW FIELD DATA FOR REBUM  C COMMON JATHY ANGRANGH, RACON-SCOVICED  C COMMON JATHY ANGRANGH, JM, KM, XMAC+JALDMA, GAM-SAMMI, CM, DT, SMI, IPRT,  C CHRON-NCA-NCA, NCO, AR, M, DOREGA, MU, ML, IT, TAN, TYSO, FMT, PTORT, PIMF,  C IMAG, OTHER, CONT, KCO, CONTO, SCON, CONTO, CONTO,  C DMAN FLUMT/ THETALSJ, PP(20, 25), VALUMT  TORMON JONSTRY, PQLOT, MTEMO, MYADO, SUPELOT  COMMON JONSTRY, PQLOT, MTEMO, MYADO, MYALON  COMMON JONSTRY, PQLOT, MTEMO, MYADO, MYALON  COMMON JONSTRY, PQLOT, MTEMO, MYADO, MYALON  COMMON JONSTRY, PQLOT, MTEMO  COMMON JONSTRY, PANOLODI, STORAW  COMMON JONSTRY, MANOLODI, STORAM, PRO, MIMEX  LOGICAL LEGEUM, PRELIMENTE, LPREST, LPRCON, LPRA, PLOTALTAJLESTOT  COMMON JONSTRY, MYADALTO, PRELIMENTALIZOL, THANSICIO, MYADALT MTEMAJICO),  ** TRANSICOLD, MYTRAJICODI, MYTRAJICOL, THANSICIO, MYTRAJICODI,  ** TRANSICOLD, MYADALTO, MARKT, MARKT(12)  LOGICAL LELTAJ  TOMMON JONSTRAJICODI, BYTRAJICODI, PTOPAJICODI, POTRAJICODI,  ** TRANSICODI MARKT, MARKT(12)  LOGICAL LELTAJ  TOMMON JONGTRY LELTBIJARLHT, VIME, RHOINF, THPINF, BIME  COMMON JONGTRY LELTBIJARLHT, VIME, RHOINF, THPINF, BIME  COMMON JONGTRY LELTBIJARLHT, VIME, RHOINF, THPINF, BIME  TOSICAL LELTAJ  THEMSION INCLOOR  TRANSICODI NATANG, POLAMG, RYI, RYI, FILL  THEMSION INCLOOR  TRANSICODI NATANG, POLAMG, RYI, RYI, FILL  OUTSALLECCE (RRIL), YY(11)	THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT COUNT COUNT COUNT COUNT OUTSTREE JUSE JUSE JUSE JUSE JUSE JUSE JUSE JU	2323232347227234672
c c c c c c c c c c c c c c c c c c c	TURBOUTTNE IJTRAJ(XP,YP,IT,JT,OI,OJ,4FLAG)  THIS SUBROUTINE LOCATES A TRAJECTORY POINT IN THE COMMUTATIONAL GRIO  IT,JT IS LOWER LEFT CORMER OF GPIO SECTION CONTAINING (XP,YP)  COMMUN FALUNT, THETA(25),PP(22),25),NRLINT COMMUN FALUNT, THETA(25),PP(22),25),NRLINT COMMUN FALUNT, THETA(25),PP(22),SEC,NRLINT COMMUN FORD, ANGIOLOLISTADOS (101),TER COMMUN FORD, ANGIOLOLISTADOS (NTAIL),PEC COMMUN FORD, ANGIOLOLISTADOS (TOTA),PF(20,100),PF(20,100),PF(20,100),PF(20,100),PF(20,100),PF(20,100)  ON THE STANDARD (TO SECTION OF THE SECTION	FLOSFY  [JTRA]	136 137 2 2 2 3 4 5 6 7 6 7 6 7 6 7 6 7 6 7 6 7 7 8 7 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	C THIS ROUTINE BEADS ALL DATA PEOUIRED COR ONE CASE, EVCENT FLOW FEELD DATA FOR REBUM  C CHMON MATHY ANDRAMOM, RECONAGED WAY, CAMPA, CAMPI, CM, DT, SMI, TRET, COMMON MATHY, ANDRAMOM, RECONAGED WAY, MASTA TAN, TISCO, FMT, PTORT, PIMF, COMMON MAS, NCC, AB, MOREGA MA, MASTA TAN, TISCO, FMT, PTORT, PIMF, COMMON MAS, NCC, AB, MOREGA MA, MASTA TAN, TISCO, FMT, PTORT, PIMF, COMMON MAS, THE TANGENCOME 201, XECOMA RECONEZ: COMMON MASLAY, KYON, VECOME 201, XECOMA RECONEZ: COMMON MASLAY, FALTA (25), PT (22), XECOMAGED WAS COMMON MASLAY COMMON MASLAY, MASLAY, FALTA (25), PT (24), PT (25), THE TANGEN MASLAY COMMON MASLAY, ATACH, FARMA MAS, MASLAY COMMON MASLAY, MASLAY, FARMA MASLAY, MASLAY COMMON MASLAY, MASLAY, FARMA MASLAY, MAS	THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT THEOUT COUNT COUNT COUNT COUNT COUNT OUTSTREE JUSE JUSE JUSE JUSE JUSE JUSE JUSE JU	232323272727274627
c c c c c c c c c c c c c c c c c c c	THIS SUPROUTINE LITRAJ(XP,YP,IT,JT,OT,OJ,MFLAG)  THIS SUPROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRIO  IT,JT IS LOWER LEFT FORMER OF GPID SECTION CONTAINING (XP,YP)  COMMON ADUNDSY XMODISCLEY YMODISCLEY XMONITOR COMMON ADUNDSY XMODISCLEY YMODISCLEY XMONITOR LEVEL 2, AMG,DXITH,DEG COMMON JORD/ ANGIZZJJDJ),DXT4(1CG),PG COMMON JORD/ ANGIZZJJDJ)  TE (1-CTATAJ),DTTATAJ/DXT4(JT) TJ-J-J JJ-(1-CTATAJ),DXT4(JT) TZ-J-J JJ-(1-CTATAJ),DXT4(JT) TZ-J-MANAX P1-RZ ZZ-MROKI,JT)-QJ-4PF(1,JT-1)-C1-J-QJ) TE (0-LT-PZ),DAGAT P1-RZ ZZ-MROKI	FLOSFY  LITERAL	1901 2 2 4 5 6 7 6 7 2 3 2 3 2 5 11 1 17 5 9 6 7 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	C THIS ROUTINE BEADS ALL DATA PEOUIRED TOP THE CASE,  C EVCEPT FLOW FIELD DATA FOR REBUM  C COMMON JATAY, ANGR, ANGR, RACKON, BCCON(22)  C COMMON JATAY, ANGR, ANGR, ANGR, KAYACA, ALDMA, GAM, GAMMI, CM, DT, SMI, IPRT,  C CHRON, NCA, NC3, NCC, AR, M, OMEGA, MU, ML, IT, TAN, ITSO, FMT, PTORT, PINF,  C THE CONTY, KCOM, WCOW(20), KCOM, CON(2)  C COMMON JOENTY, THE TAIZSI, PP(20, 25), WALLINT  TOHNOM JOETTY, THE TAIZSI, PP(20, 25), WALLINT  TOHNOM JOETTY, THE TAIZSI, PP(20, 25), WALLINT  COMMON JOETTY, DECTA, ZLF, ZTRAN, DZTRAN  LOGICAL LGBAW  COMMON JOETTY, THE JOETTY STORE AND JOETTY  COMMON JOETTY, THE JOETTY STORE AND JOETTY  COMMON JOETTY LATES UNDERFREIN PROCON, LORAN JOETTY COMMON JOETTY AND JOETTY STORE AND J	THENT THENT THENT TO THE THENT THE	2 3 2 3 2 3 2 3 2 3 2 7 4 5 7 2 7 1 2 2 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 2 3 3 2 3 3 2 3 3 2 3 3 2 3 3 2 3 3 3 2 3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
ccccc	THE SUPROUTINE LITERAL(XP,YP,IT,JT,OI,QJ, 4FLAG)  THIS SUPROUTINE LOCATES A TRAJECTORY POINT IN THE COMMUTATIONAL GRID  IT,JI IS LOWER LEFT CORMER OF GPID SECTION CONTAINING (XP,YP)  COMMUN FALUNTY THETAL(25),PP(22),25),NALINAT COMMUN FALUNTY THETAL(25),PP(22),35),NALINAT COMMUN FALUNTY THETAL(25),PP(23),NALINAT COMMUN FORDY ANGIOLOLIST PROPROUTING EYEL 2, ANGIONITH,DEG COMMUN FORDY ANGIOLOLIST PROPROUTING  POINT IS IN POLAR COORDINATE PEGION  IF (YP .GE. 0.6) SO TO SO THITALATANZ(YP, -TRIBORE DESCRIPTOROLIST PROPROUTING J TAMELATANZ(YP, -TRIBORE DESCRIPTOROLIST PROPROUTING J TAMEL	FL COFY FL COF	136 137 2 2 2 3 4 5 6 7 6 7 6 7 6 7 6 7 6 7 6 7 7 8 7 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	C THIS ROUTINE BEADS ALL DATA PEOUIRED COR ONE CASE, EVCENT FLOW FEELD DATA FOR REBUM  C COMMON STATE ANDROANGE, RECOMESCON(20)  COMMON STATE ANDROANGE, RECOMESCON(20)  COMMON STATE ANDROANGE, RECOMESCON(20)  COMMON STATE, THE STATE S	THEOUT TREATT TREATT TREATT TREATT TREATT TREATT TREATT TREATT TREATT THEOUT	2 3 2 3 2 3 2 3 2 7 4 5 2 2 7 3 2 7 4 7 2 2 2 2 2 3 2 4 7 2 2 5 2 5 6
ccccc	THIS SUPROUTINE LITRAJ(XP,YP,IT,JT,OT,OJ,MFLAG)  THIS SUPROUTINE LOCATES A TRAJECTORY POINT IN THE COMPUTATIONAL GRIO  IT,JT IS LOWER LEFT FORMER OF GPID SECTION CONTAINING (XP,YP)  COMMON ADUNDSY XMODISCLEY YMODISCLEY XMONITOR COMMON ADUNDSY XMODISCLEY YMODISCLEY XMONITOR LEVEL 2, AMG,DXITH,DEG COMMON JORD/ ANGIZZJJDJ),DXT4(1CG),PG COMMON JORD/ ANGIZZJJDJ)  TE (1-CTATAJ),DTTATAJ/DXT4(JT) TJ-J-J JJ-(1-CTATAJ),DXT4(JT) TZ-J-J JJ-(1-CTATAJ),DXT4(JT) TZ-J-MANAX P1-RZ ZZ-MROKI,JT)-QJ-4PF(1,JT-1)-C1-J-QJ) TE (0-LT-PZ),DAGAT P1-RZ ZZ-MROKI	FLOSFY  LITERAL	136 137 2 2 2 3 4 5 6 7 6 7 6 7 6 7 6 7 6 7 6 7 6 7 7 8 7 8	C THIS ROUTINE BEADS ALL DATA PEOUIRED TOP THE CASE,  C EVCEPT FLOW FIELD DATA FOR REBUM  C COMMON JATAY, ANGR, ANGR, RACKON, BCCON(22)  C COMMON JATAY, ANGR, ANGR, ANGR, KAYACA, ALDMA, GAM, GAMMI, CM, DT, SMI, IPRT,  C CHRON, NCA, NC3, NCC, AR, M, OMEGA, MU, ML, IT, TAN, ITSO, FMT, PTORT, PINF,  C THE CONTY, KCOM, WCOW(20), KCOM, CON(2)  C COMMON JOENTY, THE TAIZSI, PP(20, 25), WALLINT  TOHNOM JOETTY, THE TAIZSI, PP(20, 25), WALLINT  TOHNOM JOETTY, THE TAIZSI, PP(20, 25), WALLINT  COMMON JOETTY, DECTA, ZLF, ZTRAN, DZTRAN  LOGICAL LGBAW  COMMON JOETTY, THE JOETTY STORE AND JOETTY  COMMON JOETTY, THE JOETTY STORE AND JOETTY  COMMON JOETTY LATES UNDERFREIN PROCON, LORAN JOETTY COMMON JOETTY AND JOETTY STORE AND J	THENT THENT THENT TO THE THENT THE	2 3 2 3 2 3 2 7 4 5 2 2 7 2 7 2 7 2 2 2 2 2 2 2 2 2 2 2 2

	READ(5,114) AMACH, GAPMA, HRO, XCALC, HR, HRLUNT, CH, ITER	INPUT	29	WRITE(6,240)	IMPUT	113
	HUB He HEU	INPUT	30		ENPUT	114
	REAN(5,120) LRERUN, LPRFL, LPRST, LPRCON, LPRA, LPLAT, LTRAJ, LRSTRT	IMPUT	31		MPIT	115
	TERULTPASSI XPLUTSANGPSANGPSNXADDSLGRAV	INPUT	32		I N P'ST	
	IF (LPLOT) LPRCON.TRUE.	THPIT	"		INPUT	116
	TE (XPLOT .GE. G.O) XPLOT==1.)	INPUT	34			117
	/ PL U1 == KPLU	INPIT	35		THPUT	110
	PEAD(5,14G) KYCDM	INPUT	36		THPUT	110
	IF ERVERN .GT. 01 READ(5,160) (VCDM(II),T=1,KVCDM)	INPUT			THPIT	120
			37	**************************************	INPUT	121
	TE (KRCON . GT. D) READ(5,16C) (RCON(1),1-1,KPCON)	THPUT	3 6		IMPUT	122
	READIS-1431 KRCOM	ENPUT	3 9		[NPI)T	123
	TERMODE AT 15 DESCRIPTION	THPUT	40		Ment	124
	TF (KACON .GT. 3) READ(5,160) (ACON(1),1-1,KACON)	INPUT	41	103. FORMATCHAIS)	PHPIT	125
	TE CONT. LIBAJI GO TO 5	IMMIT	42	113 FDRMATCAF15.3,2113,F16.6,[10]	THPUT	126
	READ(5-170) HTPAJ, (TTRAJ(T), XTPAJ(T), YTPAJ(T), TTRAJ(T), T=1, HTRAJ)	THPUT	43	123 EDBMATCHLICA	THEIT	177
		THEFT	44	190 FORMAT (3510.G,T10,L10)	MPILT	12.
	"E#U(7,143) MM4RKT	THRUT	45		THEIT	129
	TE EMMARKE .GT. D) READES, 183) EMARKEETS, 1-1, NHARKES	INPUT	46		MPHT	130
	#tantnalto LtinaazanGaPOLANGanklanylanyl	THPUT	47	160 FORMATERFIG.01	INPUT	131
	I TESUMI CALL MUTAT(1)	THPUT	4.0		THRUT	
	CONTINUE	INOUT	40	TE, FORMAT(ATA)	I N PIJT	132
	M-4.4 M-4.4 C	INPUT	50	• • • • • • • • • • • • • • • • • • • •		133
	IF(HON.GT.O.O) N4ENDX=1	INPUT	53		MPIJT	134
	IF (LEFEUN) 60 TO 10	TYPUT		373 FORMATALIS ASSESSMENT OF THE STATE OF THE	TUPLE	135
	TE CHORN .LT. w.CT PEADES,150) NADD.(XXCT), RRCT), T-1, NADD)		52	2C) F78HAT(1H1//25X, MALU////55X, 15HINPUT VARIABLES/55X, 15(1H01)	TUPUT	136
r	acta neck acutation with tree tibest 13 talbudhi	INPIT	53	210 FORMATI // ZOX, ZSHTNTEPPLANETARY MACH NO. +,F5.2	[HPIT	137
Ċ	INTITALISE DEFAULT PARAMETERS		54		[HPUT	139
ō	INTITATE DEPARTS PARAPPIERS	IMPUT	55	214 FORMATEF/23X. 46HORSTACLE GEGHETRY: HIGER-SHEPLIED COORDINATES 1	TUPPT	139
•	TE AVELLE CE C AL VOLLA- A A	THPUT	56	*	TUPUT	146
	TF (YCALC .GE. C.O) XCALC1.0	IMPHI	57	* (3(Y,F9.4)6Y,F8.4)}	THPUT	141
	7LF+-TCALC	INPIT	5.4	215 FORMAT(//2;X,+9HORSTACLE GEOMETRY: DEFAILT MAGNETOPAUSE COORDINATA 1	THPIT	142
	AE (48 °FE° 2) Me-10	IMPUT	59		MPIT	143
	IF (MOLUMT alea 0) MRLUMT-24	THPIT	51		INPUT	144
	TF (CM .LE. J.D) CM-3.j	INPUT	61		TUPUT	
	TECTTEP.LE.O. TTER-306	INPUT	42	719 FORPATE // 20 X, 42 HORSTACLE GEOMETRY: DEFAULT TONOPAUSE PHAPE,	INDIT	145
	TE ENTADD .LE. AT NXADD-2	THEFT	65	* />39 P+314WITH GRAVITATIONAL VARIATION TH,		146
	JMAX=48LU4T+MXADD+1	THPUT			THPIT	147
	MFPSY-JMAX-1	INPUT	54 65	* /,39%,19HSCALE MFTCHT, M/Ru=,F4,2)	INPUT	149
	NRM AY ON P			223 EGGHATT//23X,37HPARAMETERS FOR ALUNT BODY CALCULATION//	THPIT	149
	দ সারু মুক্ত পার্	T NPIST	56		] 4 PIJ T	150
	47E40+J4AX-1	INPIT	67		[ M PH I T	191
	47400a	INPUT	6.8	* 254,274MC OF ADDITIONAL POINTS IN/	TUPUT	152
	YMACHHAMACH	THPUT	60	* 35% LBHRLUNT RODY MESH + + + + + + + + + + + + + + + + + + +	INPUT	153
	CTM=CTMATHT	THPHT	71	* ?5%,14HCDUPANT NUMBE#,13%,1H#,F5,2/	THPIT	154
_	· 4==, 4==	ナリテリナ	72	* 25%,17HMO. OF ITERATIONS,12%,1H=,14/	HP'IT	155
ŗ		THPIFT	72	* //2:X-42-HTERNINAL DOWNSTREAM LOCATION FOR MARCHING .	INPUT	156
Ç	WRITE DUT INPUT AND DEFAULT VALUES TO BE USED	INPUT	79		TNPUT	157
C .		TMPUT	74		THPUT	
1:	CONTINUE	THOUT	75	* F6-21	THPUT	150
	WRITE(5,27)) TITLE	INPUT		231 FORMATE //234, SUNISED SPECIFIED DEVIATION IN SOLAR-WIND COORDINATES	14501	159
	TF (LAERÚN) PETUBÑ	IMPLIT	76 77			160
	WEITER, 2103 AMACH, GARMA	INPIT	7.	* /2CT+174 FLOW DIRECTION +, F7-2, 64 DECREES	THPUT	161
	WPITE(9) NALUNT, NR, AMACH, GAMMA, 47PP	THOUT	79	A SOUTH A LINE DISTRIBUTE AND SOUTH APPROPER	TUPIT	152
	TE (4/PN) 14,16,18	IMPUT	90	1/23X+50HUSER SPECIFIED DEVTATION IN SOLAR-WITH COOPDINATES 1		153
11	WPTTF(6,214) N90D,(XX(T),PR(T),T+1,M900)	THEFT			INPIT	164
_	WPTTE(0) NROD, (YE(T), RO(T), To1, NAOD)		13	F7-2,54 DEGREES)	THPIT	145
	cu tu s'	IMPIT TMPIT	42	235 ETRMATE //23% BHL "ERUN ",L2//23%, SHLPREL ",L2//20%, SHLPRST ",L2,	INPUT	166
•	UPITE(6,216)		73	* //CJA907LP4UUM #9LG//ZLX93MLP45 #9LZ//ZNX9P419E07 ##15 1	IN PUT	167
-	57 TO 20	THPIT		" //2?%+8HLTRAJ ==L2//2?%+AHLRSTRT ==L21	THPIT	168
		THRIT	8.5	Z43 FTRMATCIMIT/45X,40MVALUES SPECIFIED FOR CONTOUR CALCULATION/	INPUT	159
1.	3 FF (LGRAY) GO TO 19	THPUT	46	* 45Y.44(1H=1)	THPUT	170
	WPITE (6,214) HCRN	T tie Mil	97	294 ""PMAT(////ZUX,12,294 CONTOUR LEVELS FOR VELOCETYII	THEST	171
	Gn Th 25	THPHT	99	244 FORPAT(////20% 12.29H CONTOIN LEVELS FOR DEMETTY::	THPIT	172
1,	WRITE (6,219) HORN	THPIT	39	Z45 FTRMATE////Z3%#1Z#444 CONTION LEVELS FOR MAGNETTE ETCIN STRENGTHER I	I M PILT	173
Z.	: CONTINUE	THPUT	90	27J F9RMAT(/(1)Y.AF10.31)	THPUT	
	WPTTF(6,22) NP, HPLUNT, HXADD, CN, ITER, YCALC	THPIT	97		THPLIT	174 175
	WRITE (6,234) XPLOT	INDIT	92			
	TF (LSUN) GO TO 17	INPUT	23		IMPHT IMPHT	176
	YPTTF (6,231) AMGP,ANGN	INPUT	94	A #84W \$4		177
17	CONTINUE	INPUT	95		THPIJT	17*
_	WP17E(5,235) LREQUNALPRELALPRETALPREMALPROTALPROTALTRAIALBETET	INPUT	96		INPIT	179
	TE (.47T. LTRAJ) ON TO 25	INPIT	97	* /23% 364VNTERPLANETARY DENSITY	THPIT	190
	9CRP+1.2/RPLNT	INPIT			[ N P) T	191
	WETTE(6,26)) LPLT#J,#GRP,VINF,#HJINF,TMPTHC		99	* /2: Y, 344INTERPLANETARY MAGNETIC FIELD	INPUT	192
	TO TOTAL MATTE SA 94 OF BUME BUT ONE OF THE ANALOGO THE	INPUT	99	263 FORWATE ////25%, THNTRAS -, 14,15%, ANNHARKT -, 13/	THPIT	193
	TF (LSUN) WRITE (6,269) SIMF, 971, 871, 871, 474MG, POLANG WPITE(6,253) NTRAJ, NHARKT	INPIT	10L	T 301,45H( + = POINT TO BE MAPKED FOR CROSS REESDEMCELIA)	THPUT	194
		IMPHT	101	* 20% pl4% pQ% pSHTTRAJa8% sHXTRAJa7% sHYTRAJa7% cH7TRA 147% cH7TRA 147%	THEUT	195
	Off 23 N=2,NTRAJ	IMPUT	162	20' *'****	THEUT	176
21	HK(N)+95LANK	[4PJT	123	ZOS "UMMBI(44Y,324(SUM-PLANFT CYCRDINATE CYCTEM))	THRIT	197
	TF (NHARKT .LE. L) FO TO 24	THPIT	104	. ZOF FUPMAT(35%,16H MAGNITUDE #.#11.3	MPIIT	
	DO 22 I=1,NMAPKT	IMPUT	175		[HPUT	198
	K=#4947{	THPUT	105			149
2	MK (K)=MTTAR	THRIT	197		THPUT	199
	CONTINUE	THPUT	130		TUPUT	191
•	VAITE (6,268)	INPUT	100		( MPHST	192
	WPITE 16,2671 (N, MK(M), TTPAJ(N), KTPAJS(M), YTPAJS(M), TTRAJS(M),	IMPUT		END APPLICATION AND APPLICATION APPLICATIO	TUPUT	193
	* M=1,HTRAJ)	IMPUT	110	1	INPUT	194
94	CONTINUE		111			
	* 1 · · · · · · · · · · · · · · · · · ·	IMPIIT	112			

	SURPOUTINE LAREL	LAMEL	2
Ç		LAPEL LAPEL	3
٢	SET OF CONTOUR LAMELS.	LASEL	
C	**************************************	LASEL	6
	COMMON /LABLS/ YLAGISO),YLAGISO),CVISO),NCL,ILGISO),NLAG COMMON /SCALE/ XSF,YSF,YMAX,YMAX,XLNGTH,YLNGTH	LARLS Scale	ž
ŗ	·	LAREL	9
C		LAPEL Larel	10 11
č		LA°EL	12
c	CALL MURRICKLAS, YLAS, CV, NCL, ILS, NLAS)	LAREL LAREL	13
C		LAREL	14
ç	FIND FIRST LABEL FROM SORTED ARRAY THAT IS ARRAY W-AXIS.	LAPEL Lapel	16 17
٠		LAREL	ie
	TECTLARCKI-LT-C-) GO TO 5	LAREL	19
		LAREL LAPEL	20
_	5 CONTENUE	LARFL	22
ç	NO LARELS FOUND AROVE X-AXIS. RAD SET OF CONTOUR VALUES	LARTL Larel	23 24
C	SPECIFIED. STOP PROGRAM.	LAPEL	25
¢		LARFL LAREL	2 % 2 7
	213, FORMATE 141,104+++++++++++++++++++++++++++++++++	LAREL	2 *
		LAREL LAREL	29
r		LAMEL	30 31
	19 T(8(1)-KMIN	L A P E L	32
		L 4 9 E L L 4 9 E L	3 2 3 4
c		LAREL	3 5
ç	FYANTHE ALL LABELS REYOND LABEL KHIN FOR OVERLAR.	LAPEL LAPEL	36 37
٠	W=2	LAREL	38
	KWINPOKPIN+1	LAMFL	30
	On it i=kmimp, ncl tervimety, ttylimekmim+, 1/ysp, and, xiamety, lt, xiamekmim)	LAMEL LAMEL	41
	1 4,4,1,1,40 10 13	LAPIL	47
ç		LAREL LAREL	44
ř		LAPEL	4 5
		LARSL LARSL	47
	V! AQ=K	LARFL	7.4
	4 = 4 + 1	LAPEL	49
c		LAPEL LAPEL	5 C
C	INSUPE THAT THE LAST LAREL IS PLOTTED.	LAREL	52
C		ĒARĒĒ ta¤#L	53 54
r		LARFL	5 5
C		LAMFL LAMEL	56 57
	FND	LAPEL	5.0
		MAP	5
c	+ antenating surveyants	HAP	4
ç	CONTOUR PROGRAMS MAP, WALK, SERCH, ENTER, AND CHECK	HAP	5
Ċ	WEITTEN AY REESE SORFHSON, MASA-AMES PRS. CTR., AUG., 1974. (MONTFIED VERSION)	MAP MAP	6
ċ	Company and Artificial Company	MAP	•
ç	THIS SUBROUTING AND THOSE WHICH IT CALLS PREPARE DATA FOR CONTOUR PLOTTING.	MAP .	10
0000	FIRE CHALOUS PERFITENCE	MAP	11
¢	CALLING PARAMETERS)	47 b	12
ç	A TWO-DIMENSIONAL ARRAY TO BE CONTOUR PLOTTED.	447	13
č	JOIN FIRST-POSITION DIMENSION-SIZE OF A. Y. ARRAYS TO CONTAIN CONTOIN LINE DATA UPON RETURN.	HAP	1:
č	TAY ARRAYS TO CONTAIN CONTOIN LINE DATA UPON RETURNA EACH PAIR OF XEED AND YEED PERRESENTS & POINT ON A	MA P Ma P	16 17
č	CONTOUR LINE.	MAP	1*
c	NOTH TS THE MURRER OF CONSTANT-A CONTOUR LEVELS.	MAP	19
C		MAP	20
С	MINIMUM VALUES OF A.	MA P	22
C	-2 IF CONTOUR LEVELS ARE TO RE REVEN BY THE USER.	-47	23

....

```
ACOUNT ARPAY OF CONTOUR LEVELS. SCHATCH IF KOD-1.
IF KOD-2, ACOUNT HUST BE FILLED WITH MONOTONICALLY
INCREASING CONTOUR LEVELS. SHOULD BE DIMENSIOMED
 -
 26
27
26
29
30
31
 MAP
 AT LEAST MLIN.
 AT LEAST MLIN.
IT SHOULD BE RECOGNIZED THAT MANY CONTOUR LINES MIGHT RESULT FROM EACH CONTOUR LEVEL.
UPON RETURN, MAD(1) IS THE TOTAL MUMBER OF CONTOUR
 MAD
 ...
 MIGHT RESULT FOR SACH CONTRINE LEYEL.

IPON RETURN, MADEI IS THE TOTAL NUMBER OF CONTOUR
LINESS. ALL THE LINES ARE RUN-TOGETHER, MEAD TO TAIL
IN ARRAYS X AND Y. THE FIRST LINE STARTS AT XII)
AND YII) AND EMDS AT XIII AND YII; FOR IT-MAD(1)-1.
THE N-TH CONTOUR LINE STARTS AT XIII AND YII; FOR
IT-MAD(N) AND EMDS AT XIII AND YII; FOR IT-MAD(N) FOR N.GEG. IS THE STARTING ANOPERS IN Y AND Y
OF THE N-TH CONTOUR LINE.

ISIZI DIMENSION SITE OF A AND Y.
ISITED DIMENSION SITE OF AND.
IT IS DIMENSION SITE OF AND.
IT IS DEFENDS ON THE DIMENSION SITE OF ARRAY A,
THE VALUE OF HILM, AND THE DEFERE OF ECCENTRICITY
OF THE SURFACE PEPRESSUTION BY APRAY A. E-POR MESSAGES
WILL RESULT IT THESE ARRAYS APE TOO SMALL.

ICHY AN ARRAY TO BE USED AS SCRATCH BY THE CONTOUR PROGRAMS.
IT'S NOULD HAVE AT LEAST 4-SIZI CELLS.

JHIN,KMIN,JHALKWAX IT IS RECOGNITED THAT ONE MIGHT.
STARTING AT SOME VALUE LARGER THAN 1. THIS SUMBOUTING
WILL PROCESS ARRAY A 1, 1 FOR JMIN-LE-JALE, ANAY,
AND VIINALE-SCLEEKENS. JAIN, METH, JURES, AND WHAZ
 MAP
 HAP
 HAP
 33
34
35
36
37
38
 MAP
 HAP
 HAP
 HAP
 MAP
 MAP
 MAG
 PAP
 RAP
 44.
 AND KNIN-LE-K-LE-KMAY. JAIN, KMIN, JMAX, AND KMAX
ARE THE LIMITS ON THE SUBSCRIPTS. JMIN AND KMIN MAY
 ...
 -4-
 53
455
57
58
56
51
 HAP
 DIMENSION ACLIBATION YCLIBACONTCLIBANDCIDA TOURCEALIS
 MA.
 TOFX(J.K)=J+(K-2)+JOIN
 -
 MIPA DEA FAMA CETT
 -
 APAY-LITT
 -
 63
 HEP
 ALTHER (1)

L-IDEA(1)*;

L-IDEA
 MAP
 65
 HAP
 66
 TFEVAL-AMARIZ-1-3
 MAP
MAP
 68
59
70
71
72
73
 AMAX- VAL
 GR TR :
TFEVAL-AMENIA.1.1
 HAP
 AMIN-VAL
 CONTINUE
 HAP
 FIND ACOUNT BY LINEARLY INTERPOLATING OF TO 45,63,600
 H4.
 75 77 78 9 1 1 2 3 4 4 5
 OFF-CAMAX-ANTHIFFCGATCHLIN+11
 MAP
 DO 7 N=1, NLIN
 ACONTENT - AHIN-FLOATENIONEF
 ...
 WPT No 1
 MAP
 NHAX-METH
 eg to •
 MAP
 CHECK ACONT IF GIVEN BY USER
 HAP
 MHIMOD
12
 -
 TECHNINGTONLING GO TO 9
IFLAMINGTOACONTONTHY
 ...
¢
 MAP
 90
 NMAX-NL TH+1
11
 MMAY-MMAX-1
 91
92
93
94
95
97
98
 TFENMAX.LT.13 GO TO 9
TFENMAX.LT.ACONTEMMAX13 GO TO 11
TFENMEN.GT.NMAX1 SO TO 9
 -47
 HAP
c
 MAP
MAP
MAP
 TE ENMINATO.MMAX) GO TO 12
 MST-MMTN+1
DP 13 N=WST, NMAX
 TELACONTINI .LE.ACONTIN-133 GO TO 9
 MAP
13
 CONTIMIE
 100
 MAP
 121
 MAP
MAP
 107
 PART IS OF AROUND THE ROUNDARY LOOKING FOR LINES WHICH
 THTEPSECT THE BOUNDARY.
 105
 WAD [1 1-0
 -
 MAP
 KOKHIN
 -
 187
```

	MINT-2-(JMAX-JMIM)+2-(KMAX-KMIM)						
	KOB7=2	MAP	100		TF(ND'JM.GT.15172) GO TO 35	HAP	197
		MAP Map	129		MAD (1) = NDUM	MAP	193
	I-IDER(JMIN, KMIN)	HAP	111		CALL ENTER(KOD2, J.K. NVAL, AL, AZ, JMIN, KMIN, ICHK, KOD4, X, Y, MXY, ACRNT,	MAP	194
	44-4(1)	MAP	112		• ISIZI)	MA P	195
С	MAA-C	MAP	113		TF(KND4.E0.2) 50 TO 73 NAO(NOUN)-NAY	MAP	195
	NG 26 N=1, NENT	MAP	114	c		MAP	197
	GO TO (21,22,23,241,KOD7	MAP	115	Č	MOW ENLLOW UP THIS LEAD, JALK THE LENGTH OF THE LINE.	HAP	198
c	an in the The The The Annie	44	116		KU05-KU07	HAP	220
Č	ORIENTATION IS UPWARDS	MAP	117		K 006-2	HA P	201
21	J=1-1	MAP	110		12-1	MAP	272
	T-TREY(J, w)	HAP	119 120		KZek	MAP	203
	IF(J.GC.JMIN) GO TO 25	942	121	36	CALL WALKINGOS, JS, KS, A, JDIM, TCHK, JMEN, JMAY, KNTH, KNAY, KOMA, NXY,	MAP	204
	1-14LM	MAP	172		* ACTHT,KOD6,X,Y,HVAL,TS[71) TF(KOD4,E0.2)	m & •	225
	1-17EX(J+++1)	MAP	123		1F(KND5-6T-w) 60 TO 36	M4 P	236
	K007=2	440	124	e	171,000,001.001.00.10.30	MAP	207
	400201 40 79 25	MAP	125	29	CONTINUE	MA P	208 239
c	10 11 25	MAP	126	20	CONTINUE	***	210
č	PRIENTATION 2: TO THE RIGHT	MAP	127	Ċ		MAP	211
22	K=K+1	MAP	124	c		MAP	217
	T=T0Fx(J=K+1)	MAP	150	c	PAPT 21 SCAM THE WHOLE FIELD FOR LINES THAT DON'T INTERSECT	MAP	213
	TELKALTAKHAN) EO TO 25	MAP	130	c	suc alling DY b.A.	MAP	214
	T-TDFY(J+1,K)	HAP	131 132		Je- J-47-1	MEP	215
	4 UD 7 = 3	440	132		4E-KHBA-1	<b>#AP</b>	216
	K-UUS=5	MAP	114		TO 45 KEKPTNAKE TETOTYEJHTNAKS	MAP	217
_	FD TO 25	MAP	135		\$5=811}	MAP	21.
5		MAP	136		DU 40 1-1HIN'TE	HAP	219
c	ORIENTATION 31 DOWNWARD	MAP	137		4)=42	HAP	550
23	1-1-1 1-1-1-1	44.0	130		DO 44 KON2=1,2	MAP	221
	- and	MAP	130		50 TO (41,42), MOD2	HAP	222 223
	TF(J.LT.JMAX) GO TO 25 K-KMAX-1	MEP	147	41	TECJ.ET.JHIN) GTTT 44	445	224
	1=[0;1(J,K)	MAP	141		T=TOFY(1,K+1)	HAP	225
	KND7=4	445	142		A2-4(I)	MAP	556
	#0u5•T	MAP	143		60 TO 43	HAP	227
	an trige	MAP	144	42	T=IDFY(J+1, 4)	HAP	228
c		44.	146		A2-A(T)	MAD	***
c	OPTENTATION 48 TO THE LEFT	MAP	147		TECKEED KHIN) FO TO 44	MAP	230
24	# <b>- t - }</b>	MAP	144	43	COMTTANIE	MAP	231
	T-Inex(J,*)	MAP	140	Ç	Advantage of the second of the	PAP	232
	TECK.GE.KMIN) GO TO 25	MAP	150	c	FIND A4 AND AL	MAP	233
	K-KHTH	MAP	151	45	TF(A1-A2)45,45,46 AM=A2	HAP	234
	J=J4AT+;	MAP	152	• 2	4(=4)	MAP	235
	1=10Ex(1=x)	MAP	15?		ar to 47	MAP	236
	#JU5-5	MAP	154	46	AH-A1	HAP	237 23P
r	-11.545	MAP	155	70	41.42	MAP	
Ċ	FIND AN AND AL	MAP	156	c		PAP	239 24*
25	AR+AA	MED	157	Ċ	CHECK TO SEE IF A CONTOUR LINE PASSES THROUGH THE INTERVAL	HAP	241
	44-4(7)	MAP	15* 15*	c	UNDER CONSIDERATION.	MAP	242
	TF(4P-44)?6,26,27	MAP	160	47	KU6+=1	MAP	243
26	&4-&\$	MAP	151		UU TE MATHEMATA	MEP	244
	4L-4R	MAP	162		VAL=4CONT(NVAL)	HAD	245
	GO TO 24	MAP	163		CO TO (49,50),K008	MAP	244
27	44-44	MAP	164	49	IF(VAL.LT.AL) GN TN 48 KNN9-2	MAP	247
_	41-44	447	165	<b>5</b> .		MAP	248
c		MAP	166	č.	TERMAL.GT.AM) GO TO 44	MAP	249
٤	CHECK IN SEE IF A CONTOUR LINE PASSES THROUGH THE INTERVAL UNDER CONSIDERATION.	MAP	167	č	WE HAVE FOUND A POINT ON A CONTOUR LINE. CHECK TO SEE TH	747	256 251
7.8	AUD8=1	MAP	165	č	TT TO A NEW DISE. OR TE ME HAVE ALREADY DONE THREE LIVE	PA.	??! ?5?
- 0	DD 29 MVAL=MMIN,MMAX	MAP	159	-	CALL CHECKETCHK-MAA-KOUS- 1-K-AAT-KOUAS	HAP	25?
	VAL -ACONT(NVAL)	MAP	170		TF(KN09-E0-2) 60 TO 48	HAP	254
	60 TO (37,30),K098	MAP	171	c		PAP	215
37	IFIVAL-LT-AL) GO TO 29	MAP	172	С	WE HAVE A POINT. ENTER IT IN THE TARLES.	440	256
٠.	AUDUS.	PAP	173 174		# UU 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	MAP	257
30	TF(VAL-GT-AH) 60 TO 23	MAP	175		TECHNIMAGT. ISIZ2) AO TO 35	44 9	>5 a
č		MAP	176		MAD(1)=WDIJM	449	259
C	CHECK TO SEE IF THE CONTOUR LINE POINT JUST FOUND IS A	HAP	177		CALL ENTER(KOD2, J,K, NVAL, A1, A2, JMIN, KMIN, TCHK, KMD4, X, Y, KKY, ACCMT, 15 TZ1)	MAP	760
C	NEW ONE, OR THE TAIL END OF THE ALREADY FOUND.	MAP	176		TFEKNN4.E0.21 GO TO 70	MAP	261
	CALL CHECKLICHK, NXY, KODZ, J, K, HVAL, KOD9)	MAP	179		NYD(NOME NXA	MAP	252
_	[f(KOD9.EQ.12) GO TO 29	-46	180	¢	that will want	HAP	253 264
Ç	APT-2814 A AND A A	MAP	181	ć	MMW WALK THE LENGTH OF THE LINE.	HAP	255
c	DETERMINE AL AND AZ	MAP	132	•	KON5+KON2	MAP	766
	TF(KN)77.E0.1.0R.KN97.E0.4) 57 TO 32	MAP	193		K006+2	MAP	257
	41-49	MAP	194		44421=4X4	PAP	269
	40 Th 13	MAP	195 186		15-1	440	260
32	AZOAR	MAP	197		KSeK	MAP	270
	A1=A4	MAP	156	56	CALL VARKIKODE, JS.KS, A, JOEP, ICHK, JHIN, JHAY, KHIN, KHAY, KOD4, HXY,	MAP	*71
¢		MAP	199		ACONT, KODO, X, Y, NVAL, ISTZ1)	MAP	272
C	ENTER IN THE TABLES THE POINT JUST FRUND.	MAP	196		TF(K004.E2.2) 60 TO 70 TF(K005.6T.0) 60 TO 56	HAP	273
33	MDUM=MAP(1)+1	MAP	191	c	11.10.12441441 60 10 30	MAP	274
				-		747	275

¢	IF THIS LINE IS A CLOSED CJRVE, CLOSE IT MY ENTERING FIRST	HAP	276	C TPLOT • 4 FOR TEMPEPATURE PLOT PLOTCM 1	1
r	Pnint AGAEN. TIST-SORTE(YENKYST)-X(NKY))PP2+(YENKYST)-YENKY)}PP2) TFENTST.AT1.42) GN TO 4A	MAP MAP MAP	277 278 279	C IPLOT = 5 FOR PERPENDICULAR 8-FIELD COMPONENT PLOT PLOTON 1	2
	4x4=4x4+1	HAP	290	C PLOTEN 1	l 4 l 5
	TF(NY4.GT.TSIZI)	447	281 282		2
	Y(HXY)=Y(HXYŠT)	-49	293	* N®MAX, MXMAX, AMACH, GAMMA, HPO, MHINOX AJUNOS AJUNOS	3
	TCHKE1, NXY) = TCHKE1, NXYST) TCHKE2, NXY) = TCHKE2, NXYST)	MAP	284 295	COMMON /SCALE/ XSF, YSF, XMAX, YMAX, YLNGTH, YLNGTH SCALE C PLOTCH 1:	2
	TCHK(4, MYY) = TCHK(4, MYYST) TCHK(4, MYY) = TCHK(4, MYYST)	MA P	2 4 6	r Pirich 2	ó
c		MAP	258	C PLOT STREAMLINES PLOTON 2 C THE FIRST CALL TO PLOT INITIALITYS THE PLOTO 2	1
44	CONTINIE	MAP	299 290	C SCALE FACTORS APE FORMAL TO 1. PLOTON 2	3
40	CONTINUE	H&P	291	C SUBROUTINE SETUP ESTABLISHES PERMANENT PLOT ORIGIN, PLOTON 2: C DRAWS AYES, LABELS, AND TITLE. PLOTON 2:	
ć	ENTER END DE LAST LINE IN RODKKEEPPING ARPAYS.	MAP	293	C SUPPOUTING BOUND DRAWS AND LABELS SHOCK WAVE, PLANET, PLOTEN 2	6
•	43.44.4.4.4.4.1	MAP	294	C (TRODY=1) ROUNDARY. PLOTCH 2:	
7.:	HDUH-NAC(1)+1 TF(NDUM-GT-TS122) GO TO 35	MAP Map	295 296	C PLOTCH 2: PLOTCH 3: PLOTCH 3:	
	av D ( such a b = a k A	M&P M&P	297	CALL DASHID-GU-P-GU-P-GU-P-GU-P-GU-P-GU-P-GU-P-GU-	1
c	49 19 34	MAP	298 299	FALL PLOT(3.44-12.60-3)  CALL SETUPE(PLOT, AMACH-GAPMA, WHINDY)  PLOTCH 3:	
C 35	WRITE TERMS MESSAGES.	MAP	30A 301	CALL MOUND PLOTEN 30	
ິເວ	FORMAT(47H1CONTOUR SEARCH ABORTED - TARLE OVERFLOW IN MARY	HAP	377	CALL PLOT(X MAX o G o J y = 3) PLOTEN 3	
	NAD111=TTT2-1 GO TO 34	MAP	303 304	CALL 929ET PLOTCH 3: CALL PLOTC2+3+0-0+-3+ PLOTCH 3:	
Ç		MAP	305	PETTIPN PETTIPN 31	•
	WRITE(A,133) FROMATCLHLA_SXASCA++1AZXAZCHEXECUTION TERM*NATEDAZYASCEH+1//	44 P	305 307	C PLOTEN AI	C
	• 114,444ARRAY OF CONTOUR VALUES THEFOREFLY SPECIFIED)	H A D	37#	C CRAN CONTRUR PLOTS PLOTS PLOTS	2
c		MAP	379 310	C PLOTON 4' 12 CONTINUE PLOTON 4.	
60	WPTTE(6,104)	MAP	311 312	"ALL PLOT(2,-12),-3} PLOT(N 4)	5
1 14	FORMATIAGHICONTOUR SEARCH AROPTED - TABLE OVERFLOW IN (X,Y))	MAP	313	CALL ROUND PLOTON PLOTON 4	7
С 34	RETURN	MAP	314 315	"ALL CONTO PLOTON 4 CALL PLOT(XMAY, 0.00, -3) PLOTON 4	8
-	FNO	- 40	316	CALL RESET PLOTON 5	
	•			### ##################################	1
				PETIIRY PLOTEN 5	3
				C CHANGE VELOCITY CONTOUR VALUES TO TEMPERATURE PLOTCM 5	14
c	SUMPRUTINE MRKPLT(X,Y,XSF,YSF)	Merbf &	2	C PLATEN 5	6
Ċ	THIS SHAPONITHE MARKS WITH A SYMBOL AND A LITTER, A-H AND J-M,	MR KPLT MR KPLT	4	ZU IPENTHA PENTKH PENTKH S FACTHOUS-SHISAMMA-RUDDHAMACHHAMACH PENTKH S	7
ċ	THISE PRINTS WHICH ARE TO BE FLAGGED TO FACTLITATE CPRISHER THE VAPIDUS PLOTS FOR THE TRAJECTORY	PREPLT	-	*VAL=MAN(1) PLOTCM 5	9
¢	CUMPLA SHABFOLS MATERIA WEBKICTSS	MRKPLT MKPLNT	?	CVALCTI=1. +FACT+(1.5-CVALCTI++2) PLOTCH 6	1
	DIMENSTON X(1),Y(1)	MBKBLT	Ģ	25 CONTINUE PLOTON 6	2
c	Dineallun avek(15)	MRKPLT MRKPLT	16 11		3
-	MATA 419K/14A,14R,1HC,2HM,1HE,1HF,24G,144,141,14K,1HL,14K/	MRKPLT	1?		
c	IF (NMARKT.EO. ) RETURM	MRKPLT PRKPLT	13 14		
	no 10g T=1, NMARKT	MRKPLT	15		
	A60%(A) H=W86KL(I)	PREPLT	17	C         PLOTER           C         PLOTER	2
	CALL CORFEXP, YP, 603,33	MRKPLT MRKPLT	1¢ 19	C THIS SURROUTING CONTROLS THE DRAWING OF THE TIME HISTORY PLOTS PLOTEB	ă.
	*C4=*0+L_G7/*SF	MRKPLT	žr		5
	YCHAYDAGCAJYSE CALL GHARCKCHAYCHAJACAG: BAMARKCIJAIJ	MEKPLT	21 27	TARLET (GC[)LAPTS,(C3])LAPTY,C3C1)LAPTX;CCC1)LAPTT,LAPTM \TAGLET\ MOMMO	2
111	I CUNTIBIE	HRKOLT	23	<ul> <li>qreal(13), qxreal(10), syreal(100), qreal(100), qreal(10),</li> </ul>	3
	#ETIPH	makafi. Makafi	24 25		2
			_	COMMON /TPOOPT/ LPLTRJ,RPLNT, VINF, PHOINF, IMPINF, BINF TROPT	•
					9
	·			C: PLATES 1	11
	SHARDYTINE PLOTON	PLOTCH	2	C PLOTER 1	12
ć	THIS ROUTINE CONTROLS THE DRAWING OF THE PLATS	PLOTON	3	NTAYIS-D PLOTES I	4
č	UCC PLOT SUBPOUTINES CALLED ARE	PLOTON	;	C PLOTES 1	14 16
C C	D ASH, ENPLT, PLOT.	PLOTCH PLOTCH	6		17
Č	PLOT . 1 FOR VELOCITY CONTOUR PLOT	PLOTCH	6	CALL TAYIS(TIMESF.TOFFST.TLNGTH.NTAYIS) PLOTER 1	9
č	IPLOT = 2 FOR DENSITY CONTOUR PLOT IPLOT = 3 FOR STREAMLINE PLOT	PL STCN PL STCN	10		20 21
			•		

	CALL OFFST(TOFFST, VOFFST, 1)	PLRTFA					
	CALL WESTON ATTONA WORLD WARE A SAME WARE	PL OTES	22 23	c		PLOTFE	184
	CALL MAKATI (ILUAN) ALBUNIMERE MAKATU MERAN) CUT ACCEL	PLOTES	24		CALL TAYTS(TIMESF,TOFFST,TLMGTH,MTAXTS) CALL VAXIS(VSF,VOFFST,BIMF,PLTSZE,42)	PLOTER	197
	CALL PLOT(PLTS7E, 2.0, -3)	PLOTES PLCTES	25 26		CALL SCALF(TIMESF.VSF.1)	PLOTES	108
ć	PLOT VY VS TIME	PL OTF9	27		CALL DEFST(TOFFST, VOFFST, 1) CALL VECTOR(TTRAJ, NYTRAJ, NTRAJ, 1, TSYM, MSYM)	PLATFA	110
ç	•	PLOTFA PLOTFA	2*		CALL PRYPLT(TTRAJ, NYTRAJ, TIMESF, VSF)	PLOTES	111
	CALL TAXISCTTHESE, TOFFST, TENGTH, NTAXIS)	PL OTF9	36 36		CALL PESET	PLOTES	111
	CALL VAVISOVSF, VOFFST, VINF, OLTSTE, 11) CALL SCALFOTTRESF, VSF, 11	PLOTES	31	c	CALL PIOT(PLTSZE, J.O 3)	PLOTF9 PLOTF9	114 115
	CALL OFFST(YOFFST, VOFFST, 1)	PLATES PLATES	32 33	¢	PLOT AT VS TIME	PLOTES	116
	CALL MEKPLT (TTRAJ, VYTRAJ, MYRAJ, 1, IS VM, MKVM) CALL MEKPLT (TTRAJ, VXTRAJ, TIMESF, VSF)	PLOTES	34	С	CALL TAXES(TIMESF, TOFFST, TUNGTH, NTAXES)	PLOTES	117
	CALL PESET	P[ 17 F A P[ 17 F A	35		CALL VAXISIVSF, VOFFST, RINF, PLTS7E, 431	PLOTES PLOTES	110
	CALL PLOTEPLTSZE, 0.0,-31	PL OT#1	36 37		CALL SCALF(TIMESF, VSF, 1)	PLOTER	120
è	PLOT WY WS TIME	PLOTFS	3.0		CALL DESTITUEST, VOFEST, 1) CALL VECTORITTRAJ, AZTRAJ, NTRAJ, 1, ISYM, MSYM)	PLOTES PLOTES	121
c	· · · · · · · · · · · · · · ·	PLOTFS PLOTFS	40		CALL MRKPLT(TTRAJoBZTRAJoTIMESFOVSF)	PLOTER	123
	CALL TAYIS(TEMESF, TOFFST, TLUGTH, MTAXIS) CALL VAXIS(VSF, VORFST, VINF, PLISZE, 12)	PLATER	41		CALL PENTERLESSE, U. C31	PLOTES	124
	CALL 35ALF1YIM65F4V5F313	PL QTF9 PL QTF9	42		CALL SMPLTES.C.,C.O.D)	PLOTES	125 126
	CALL OFFET/ TOFFET, WOEST, 11	PLOTES	43	c	• FTUP4	PLOTFS	127
	CALL VECTOR (TTRAIS VYTRAIS NIRAIS 1. 15 YM, MEYM) CALL MREPLT (TTRAIS VYTRAIS TIMESES VSF)	PLOTER	45		\$NO	PLOTFS	12* 129
	TALL RESET	PLOTES PLOTES	46			. 63164	167
c	CALL PLOTEPLTSZE,0.0,-31	PLOTFS	4.6				
Č	PLOT V7 VS TIME	PL NTES PL NTES	49 50				
c	#111 *19********** ******	PENTES	5!		SUBSTUTEME PLOTTP	PLOTTP	z
	CALL TAXISCTIMESF, TOFFST, TENGTH, NTAXIS; CALL VAVISCOSF, VOFFST, VINF, PLISTE, 23)	PLOTFS	52	Ę		PLOTTP	3
	CALL SCALECTIMESE ASE'TI	PL DTF9 PL DTF9	53 54	č	THIS SURROUTINE PLOTS (X,R) AND (Y,F) PROJECTIONS OF THE	PLOTTO	•
	CALL OFFST(TOFFST, VOFFST, 1)	PLOTF9	5.5	ŗ	TPAJECTORY, WHERE R-SORTEY-Y-2-23, USING THE SAME SCALE FACTOR	●LUTT●	ě
	CALL VECTOR (TTRAJ, VITRAJ, NTRAJ, 1, TEVA, MEVA) CALL MREPLT (TTRAJ, VITRAJ, TIMESE, VSF)	PLOTF9 PLOTF9	56 57	Ç	FOR NOTH PLOTS. CERTAIN POINTS ARE FLAGGED TO PERMIT CROSS-REFERENCING	PLOTTP PLOTTP	?
	FALL PESET	PLOTES	5 A	. Č	WITH THE PLATS OF FLOW FIELD AND MACHETIC FIELD DATA	PLUTTO	ģ
c	CALL PLOTIPLTSZE,0.0,-3)	PLOTF9	50	c	COMMON SPETTOS STYAN, STPEM, YTMAN, YTMEM, ZTMAN, YTMEN, RTMAN	PLOTTP	16
Č	PLOT TEMPERATURE VS TIME	P[ 117 F B P[ 117 F B	6C 51		COMMON /ACOUNTS/ XACOCLUSTAVACCLUSTAVACCLUSTAVACCLUST.	BOUNDS	2
C	CALL TAXISCTIMESFATOFFSTATLNGTWAWTAXIS)	PLOTER	42		· Nemey, wrmax, amach, Gamma, wen, whinhy Common / Tridat/ wiraj/traj/(100), wiraj/traj/traj/traj/traj/traj/traj/traj/t	ROSMOS	3
	CALL VATTS VSF. VOFFST. TMPTNF.P: TS7F.253	PLOTES PLOTES	6? 64		* VTPAJ(1), ), YXTPAJ(101), VYTPAJ(17(), VZTRAJ(100), T4PTXY(100),	TRJDAT	2
	CALL SCALECTIMESF, VSF, 11 CALL SERVICEST, 11	PLOTFA	55		•	TRUPPT	4
	CALL VECTOR(TTRAI,TMPTD.NTRAI,1.TCYM.MCYM)	PLNTES PLNTES	56 67		+ PTRAJ(100)	TRUPAT	5
	CALL MAKPLY(TTRAISTMPTRISTMESF.VF)	PLOTES	50	_	COMMON STROOTS LOLTRISPOLNTSVINESRHOTHESTWOTHESTHE	TROPT	3
	CALL RESET CALL PLOTEPLISZE+0+C+=3)	PL CTFS	69 76	c	TIMENSION TITLEP(2),TETLY7(2)	PLOTTO	15
ç		PLOTER	72		DATA PTON2/1-570796327/	PLOTTP PLOTTP	16 17
ç	PLOT DENSITY VS TIME	PLOTES	77		DATA PLTS76/8-9/ DATA TETLE1/104TPAJECTORY/	PLPTTP	10
	CALL TAXIS(TIMESF, TOFFST, TLMCTH, MTAXIS)	PLOTES PLOTES	73 74		DATA TITLYZ/IOHCY-Z PROJE,64CT[O4]/	PLOTTP PLOTTP	\$U 7 d
	CALL VAVIS(VFF, VOFFST, RHOINF, PLTS7E, 3D) CALL SCALF(TIMESF, VSF, 1)	PLOTER	75	r	MATA TITERE/BLMEX-R PROJE, SMCTIONI/	PLOTTP	21
	CALL DEFST(TDEFST, VOFFST, 1)	PLCTER PLCTER	76 77		ESTABLISH PLOT BOUNDS	PLOTTP PLOTTP	22 23
	CALL VECTOR (TTRAJ. ROTRAJ. MTRAJ. 1. TSYM, HSY")	PLUTES	76	ć		PLOTTP	24
	CALL MAKPLT (TTRAJ, ROTRAJ, TIMESF, VSF) CALL PECET	PLATES	79		PMPSF01-07PPENT YTMEXW7-C	PLOTTP	25
	CALL PLOT(PLTSZE,0.0,-3)	PLOTES	91		YTH!Na i.a.C.	PLOTTP PLOTTP	26 27
ć	PLOT A WS TIME	PLOTES	0?		YT=4'=6'-6' YTMIM=0.0	PLOTTP	26
č		PLOTES	43 54		7THAY = jai	PLOTTP	3 C
	CALL TAXISCITMESF, TOFFST, TLUGTH, WTAXIS) CALL WAXISC WSF, WOFFST, BIMF, PLTSZE, 40)	PLDTEG	95		TTMTM=7.6	PLOTTP	31
	CALL SCALF(TIMESF.VSF.1)	PL () T F A PL () T F B	96 97		PTPAT-7.C DD 70 N-1.NTRAJ	PLOTTP PLOTTP	32 33
	CALL DESTERMENT VOFESTAIN	<b>ቀ</b> ር በተናዓ	99		If (XTPAJ(N).GF.XTMAX) YTMAX.XTMAJ(N)	PLOTTP	34
	CALL WECTHO(TTRAJ, TTRAJ, NTOAJ, 2, TSYM, MSYM) CALL MERPLT(TTRAJ, BTRAJ, TTMESF, VSF)	PLOTF9	6 9 90		TF (YTRAJ(N).LT.XTMIN) YTMIN.XTRAJ(N) TF (YTRAJ(N).GT.YTMAY) YTMAY.TTRAJ(N)	PLOTTP	37
	CALL REVET	PLOTER	91		IF CYTPAJ(N).LT.YTHIN) YTHIN-YTRAJ(N)	PLOTTP PLOTTP	36 37
c	CALL PLOT(PLTS7E,3,9,-3)	PLOTES PLOTES	92		TF (7TRAJ(N) ₀ GT ₀ ZTMAX) ZTMAX=ZTRAJ(N) TF (7TRAJ(N) ₀ LT ₀ ZTMTN) ZTMIN=ZTRAJ(N)	PLOTTP	38
Ç	PLOT MX VS TIME	PLOTES	93 94		TF (RTOAJ(4).GT.RTMAX) RTMATHRAJ(4)	PL DTTP PL DTTP	39 47
c	PAIL TAXTOL TORSES TORSES TO MESON MESONS	PLOTES	95	7*	), CONTINUE	PLOTTP	42
	CALL TAYIS(TEMESF, TOFFST, TEMETH, WTAXES) CALL VAYIS(VSF, VOFFST, RINF, PLTSTE, 41)	PL 0749 PL 0749	96 97		#TMAX=4MAX4(XTMAXORMOSE,1.5) YTMTN=4MIH1(XTMINORMOSE,=1.5)	PLOTTP	42
	CALL SCALFITTHESP. VSF.1)	PLOTES	98		YTMAY=4MAY1(YTMAX9QND5,1,2)	PLOTTP	43
	CALL OFFST(TOFFST, VOFFST, 1) CALL VECTOR (TTRAJ, BXTRAJ, NTRAJ, 1, 1544, N544)	PLOTFS	99		THAY-AMAY1 (TTMAXORMDSE,-1,5)	PLOTTP	45
	CALL MRKPLT(TTRAJ,BXTRAJ,TIMESF,VSF)	PLOTES PLOTES	100 101		77MIN-AMI41(2TMIN+RMOS61.4)	PLOTTP PLOTTP	46
	CALL RESET CALL PLOTIFITSZE,D.O 3)	PLOTFS	102		TTMAXTAMAY1 [RTMAXODMOSF.2_01	PLOTTP	48
С		PLOTES PLOTES	103 104		XTMAX=0.504[NT(2.JOXTMAX+.090) KTPIN=".504[NT(2.JOXTMIN=.090)	PLOTTP PLOTTP	4 <b>9</b> 5 0
C	PLOT BY WS TIME	PLOTES	105		**M&F=0.50AINT(2.30YTMAY0.QQQ)	PLOTTP	51
					YT#[N=0.5*A[NT(2.0*YTN]N999)	PLOTTP	52
					• • •		

V.

IF (YTSIZE-RTMAX.GE.1.0) YCH-0.5

PLOTTP

PLOTTE

7TMAY=0.5+1 [4T(2.0+ZTMAY+.999)

¢

```
FUNCTION QUAD (X,Y,F,XP,YP)
 WRITFIG, 2333 AMACH, GAM

 TF (480) 4.6.8
 THIS PHYCTION PERFORMS A GENERALIZED QUADRILATERAL INTERPOLATION, GIVEN THE COMBINATES OF THE VERTICES, THE VALUES OF THE FUNCTION AT THISE POINTS, AND THE COMBINATES OF THE POINT AT WHICH A VALUE OF THE FUNCTION IS DESIRED, (UP, VP)
 43
 4 WRITE(6,214) NBOD, (XX([], RR([], [=1, N500]
 REPUN
 REPUN
 45
 QUAD
 6 WRITE(6.216)
 60 TO 9
8 TF (LGRAV) 60 TO 11
WRITE(6,218) HRO
 REPUN
 T AND Y ARE THE COORDINATE ARRAYS AND F TS THE FUNCTION APPAY
 DILAN
 D C DIII
 OUAD
 RERITH
 DIMENSION X(4), Y(4), F(4)
 CAUD
 60 TO 9

 50
51
 D11 & 7
 11 WPITE (6, 219) HRO
 REPUN
 $1=4.0+xp-{x{1}+x{2}+x{3}+x{4}}
 OUAD
 9 CONTINUE
 11
 OF OTH
 52
 $3=x(1)=x(2)=x(3)=x(4)
$3=x(1)=x(2)=x(3)=x(4)
 OHAN
 TPLOT==7PLOT
TF (LSUM) GR TO 17
 B.C. DIEW
 53
54
 OUAD
 RERIJN
 13
 4=-¥(1)+¥(2)+¥(3)-¥(4)
 WRITE (6,231) ANGP, ANGN

 55
 71-4-0-YP-(Y(1)+Y(2)+Y(3)+Y(4))
 12 CONTINUE
 OHAD
 15
 PERUM
 WATTE(6,23) LBERUM, LPRFL, LPRFT, LPPCON, LPRF, LPLOT, LTRAJ
FF (AMDT - LTRAJ) GO TO 25
PCPP-1ac/PPLNT
 72-7(1)+7(2)-7(3)-7(4)
 16
17
18
 REPUN
 57
58
 T3-Y(11-Y(2)+Y(3)-Y(6)
 OHAD
 RERUN
 T4=-Y(1)+Y(2)+Y(3)-Y(4)
 DILL
 RERITH
 PETPOLOCIONEN
WEITE(6,260) LPLTRJ, RORP, VINF, RHJIMF, THPIMF
IF (LSUM) WRITE (6,269) RIMF, RXI, BYI, RZI, ATAMG, POLANG
WPITE(6,263) NTRAJ, NMARKT
DO 21 H-1, NHTRAJ
DO 21 H-1, NHTRAJ
 20

 6?
61
 9=91073492074-53071-54072
C+51074-54071
 DISAR
 BERUM
 21
 O E DIEM
 62
 7-500T(9+8-4.0+4-C)
 DITAG
 RERUN
 D=SOFT(###-0.0%##\,

FTA==(##0)/(#02.3)

FF (##S(FTA) .GT. 1=[) FTA=ETA+D/A

XI=($1+FTA+52)/($4+ETA+53)
 HK (H) - HR LANK
 DILAN
 23
24
25
26
27
28
 SE O.1M
 65
 TE INMARKT .LE. II) GO TO 24
 PERUN
 01140
 TO 22 TOLONHARKT
 66
67
69
 01107-02501 [1]010.0=[1]01[].0=X]0=[2]0[].0=ETA]0[].(0X]0
0+[3]0[].(0=[A]0[].0=X]0=[4]0[].0=ETA]0[].(0=X]1
 GUAN
 PERITE
 QUAD
 22 MKIKL MATER
 REPUN
 24 CONTEMIS
 RERIJH
 CIAN
 PPITE (6,257) (N, MK(N), TTPAJ(N), TTRAJS(N), YTPAJS(N), TTRAJS(N),
 29
 70
71
 RFRIIN
 OHAD
 ILASTP.1-P
 PEPIJA
 25 CONTINUE
 72
73

 UPTTE (6,24.)
 P F 911N
 WETT-[0-242] KYCON

IF (KYCON -67-2) WRITE-[6-25] (YCOM(I)-I-1,KYCON)

WRITE-[4-244] KRCON

IF (KRCON -67-2) WRITE-[6-25] (PCON(I)-I-1,KYCON)
 REPIN
 74
75
76
77
79
79
 RFRUN
 SURROUTING RERUN

 COMMON /CONT/ KVCOM, VCOM(2)3, KRCOM, RCOM(20)
 CONT
 RFPIIN
 COMMON JECOMY MC(20,100). MC(20,100), VE(20,110), PHOF (20,10)
 FLOV
 RERIN
 TOMMON INCOME THETACEST, PP (20, 25), MILUNT
 DTDR-.01745329252
 PLUNT
 PERM
 VC DRE
 ANGP-ANGPORTOR
 CUMHUN 'NDORHOS' XBODITPESPANDETPESPANKETSSSPAZRKETSCSP

 9C
 VC DAP
 97(PI)S
 IF PRACON . GT. 03 WPITF(6,250) (ACON([],T=1.KACON)

 82
93
 NPMAY, NYMAY, AMACH, GAMMA, HAG, NHT NDX
COMMON JONS TRM/ ZPLOT, NYFNO, NZADO, NXPLOT
 REPUN
 213 FORMATE //224, 254 SHENTER PLANETARY MACH WO. #.F5.2
 DHSTRH
 DE BILL
 94
95
96
97
 LOSTCAL LEGAN
 * ///23 X.2145 PECIFIC MEAT RATIO =, F6.31
**GRMST(//2) X.46 MORSTACLE GEOMETRYS USER-SUP-LIFO COORDINATES -.
 INSTEAL LEGAY

COMMON MAIN AMERICAN MARCHARD (CONTROL OF THE MARCHARD (
 NUMBE
 PERIN
 พมุราก
 PEPUN
 74.7H POTNTS//33Y.3HY/0.11Y.3HP/0/
 RTM
 P 6 911H
 PROPT
 216 FORMATITIZOX. 49H19STACLE GEOMETRY: DEFAULT MACMETOPAUSE COORDINAT, PEMIN
 PPDPT
 90
90
91
 COMMON /SMOCKS/ DRSDN(1001), DST(50)
COMMON /MKPLTT/ MMARKT, MARKT(12)
 213 FORMATT (274%) - EQUATORIAL TRACE)
213 FORMATT (274%) - EQUATORIAL TRACE)
214 FORMATT (274%) - EQUATORIAL TRACE)
215 FORMATT (274%) - EQUATORIAL TRACE)
216 FORMATT (174%) - EQUATORIAL TRACE)
217 FORMATT (174%) - EQUATORIAL TRACE)
218 FORMATT (174%) - EQUATORIAL TRACE)
219 FORMATT (174%)
 SHUCKS
 MK PL OT
 INGTON LAITE
 TROPT
 COMMON JEGIDAT NEGGISPLME, VINE, RHOTHE, THETHE, BIME
COMMON JEGIDAT NEGGISTERAJEIDUS XERAJEIDOS YERAJEIDOS 7, 7 TRAJEIDOS
 92
 TROPT
 TRUNAT
 94
 VTRAJ(1)2), VTTRAJ(103), VYTRAJ(1C), VTTRAJ(1C), TTPTRJ(103), ATRAJ(112), BYTRAJ(103), BYTRAJ(101), RTTRAJ(100), RTTRAJ(100),
 230 FORMATC//23 %, 47HTERMINAL DOWNSTREAM LOCATION FOR PLOTTING, X/RL+,
 TRIDAT
 REPUN
 F6.21
 PTPAIRICAL
 TO IDAT
 37
 LOGICAL LINA
 SUNDAT
 COMMON /SHINDAT/ LSUN, ETPAJS (100), YTRAJS (100), ZTRAJS (100),
 SUNDAT
 120
 TRAJSCICCI, AZANG, POLANG, SYI, TYI, TZ
 SUNDAT
 SESIIM
 121
 OTHENSION PR(163)
FORTVALENCE (PR(11, YV(11)
 B C BILL
 19
20
21
22
 F7.2,94 DEGREEST

 235 FORMAT///23% OHLGREUN -.L2//ZOX.SHLPRFL -.L2//ZOX.SHLPSST -.L2,

1/23% SHLPRCON -.L2//ZOX.SHLPRS -.L2//ZOX.PHLPLOT -.L2,

242 FORMAT(IMI//55%-934VALUES SPECIFIED FOR CONTOUR CALCULATION/
 REPUN
 STHENSION HK(100)
 PERUN
 103
 REPIN
 DATA MALANK/14 / MSTAR/14+/
 PERUN
 134
 PERTM
 17º
106
137

 THIS SURROUTINE READS DATA FROM TAPEA EMPITTEN TO TAPER ON A PERVIOUS BUND TO ALLOW PESTANTING OF THE PROGRAM USING DIFFERENT CHYDING VALUES, PLOT SITE, AMOUNT MAGNETIC FIELD ANGLES, WITHOUT PEPEATING THE CALCULATION OF THE VELOCITY

 242 FORMATI(1/1/23)-12/20H CONTROUR LEVELS FOR MENORITY:)
244 FORMATI(1/1/23)-12/20H CONTROUR LEVELS FOR MENORITY:)
245 FORMATI(1/1/23)-12/20H CONTROUR LEVELS FOR MENORITY:)
246 FORMATI(1/1/24)-12/20H CONTROUR LEVELS FOR MENORITY:]
257 FORMATI(1/1/24)-13/20H CONTROUR LEVELS FOR MEGNETIC FIELD STRENGTH:)
257 FORMATI(1/1/24)-10-031)

 23
 RESTIN
 119
 REPTH
 25
26
27
28
29
 PE PIIN
 RERUN
 AND DENSITY FIELDS.
 RERIIN
 110
 BERUN
 PERIN
 # 1M1//50x, 32HINDUT FOR TRAJECTORY CALCULATION/
 PEADIGE NALUST, MARKY, AMACHG, CAMG, HROG
 PERM
 112
 REPIN
 501,32(140)////
/201,344RO/PPLANET
 BER'IN
 30
 TF (ARS(AMACH-AMACH4) .GT. 1.JE-51 GO TO 100

TF (ARS(GAM-GAMA) .GT. 1.0E-51 GO TO 100

TF (440 a.t. (...) 150 a.m. (...) 150 a.t. (...) 150
 REPIIN
 114
 PERUN
 31
 PEOUN
 /27%,34HINTERPLANETARY VELOCITY
 32
 -1 PE 11 . 3/
 R E 8114
 114
 er ellu
 33
 /204, 344THTERPLANETARY DENSITY
 *,F11.3/
 PERM
 34
35
 RERIN
 118
 PERIN
 DE DIM
 119
2 PEASCAL MASSO, CXXCII, PRCII, I=1, MBGO)
3 CONTINUE
 REPUM
 36
37
 REPUN
 120
 THU JPH- FARKE
 REPUN
 39
 RESIN
 122
 PERIN
 PRINT INPUT DATA
 265 FORMAT(45x, 30H(SUM-PLAMET COORDINATE SYSTEM))
269 FORMAT(35x, 14H MAGNITUDE ", E11.8
 45
 REPIN
REPIN
 124
 PERUN
 /35x, 144x-C74+OMENT +,E11.3
```

	:	/35%,14HY-COMPONENT =,E11.3 /35%,14HY-COMPONENT =,E11.3 //20%,29HA7!MUTMAL ANGLE = /20%,29HDOLAR ANGLE =	,E11.3/	REPUN RERUN REPUN	127 128 129			94.6 94.8 87
	_	720-727-70LDK ANGLE	,£11.31	RERIJN	136			9 Y = -
				PERUN	131			RY=-
	,	READ DATA GENERATED BY RUINT BODY CODE		RERIN	112 133			INSP
				RERUN	134			HEH
		PEAD(4) (11,THETA(11,DRSDX(1),(11,PP(1,1),1	#1. NP HAY ). 1 = 2. NR   IINT \	RERUM	133			RTOD
		OR 10 J-2,4FLUNT	-2044-44494-6944-6941	RERUN	136			ANGP
	i	PEAD(4) K, E11, YCE1, J), YCE1, J), YXE1, J), YYET,	11.9 HOELT. IL. Tal. MPMAYA	RERUN	137			AHEN
	15.	CONTINUE	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	REPUN	139			PETU
		•••••		RERIN	134	ç		
	1	RFAD DATA GENERATED BY MARCHING CODS		REPUN	140	č		
		• • • • • • • • • • • • • • • • • • • •		PEPUN	141	·	100	CONT
		N74N9=6		RERUM	142		100	PETU
		HTEND =HREUHT		RERIJN	143			END
		M7   =48L LINT + ]		RE 9114	144			
	-	NO 20. JEN7T-100		REPUN	145			
		PEAD(4) J1, Z, DRSDF(J)		REPUN	146			
		TF (INT(ENF(5)) .NE. 6) FO TO 36		s Earle	147			
		TF (YC(1,J-1) .ET. IPLOT) 60 TO 36		BERNA	14#			
		NZADD=NZADD+L		BESIN	149			FUNC
	,	DO 2" T=1,HRMAX		REPUN	150	c		
	,	PEAN(4)   12,40(1,3),4X(1,3),4Y(1,3),RHOF(1,3	)	BESIN	151	c		T415
		YC ( 1, 4) + 7		PERUN	152	C		
		CONTINUE		& conk	153			COMM
		CONTINUE		b é sil #	154		•	- 48
	,	PETIPN		RERUM	155			COMM
				RERIIN	156			LEVE
		PRINT ERROR MESSAGE IF TOPE4 IS MOT THE SAM SPECTFIED IN CARD INPUT - PROGRAM IS STOP	E CASE AS	46 61114	157			COMM
		JACTOTED IN COUNTRACT - SEDENME IS SAUD	et.	RERUN	158	Ç		
				RERUN	159	ç		TF P
	103	URTTE(6,10,6) AMACH,GAM,HRO,AMACHA,GAMA,HRO		BEBIJA	160	c		
1	red_	FORMAT(141,19x,5(140),2x,28HEVECUTION TERMS 34H9FPUN DATA ON TAPE4 DOFS NOT AGRES	TATED 2X,5(140)//20X,	RERUN	151			[F (
	•	34M45MA DRIE ON 14ME4 DOGS MOI WORFF	SAX TOWNETH CAZE >	BEBIN	162			REIN
	•	2445PECTFIED ON CAPD THPUT: //ZBX, 84MA	74 NO., 67, 5H6AMMA, 0X,	46474	153	_		PFTIJ
	•	4HH/91//12Y+10HFROM CARDS+3(4X+F10-4)	/17X,10HF904 TAPE4,	RESTIN	164	c		
	•	3(44,F10,41)		RERIJN	165	ç		RPAC
		¢Ţnp		REPIN	166	•	٠.	CONT
		ENU		# E #(14	167			Y-YC
								Y-YC
								.2.0
								20 5
								44-4
		CURPOUTTER ROTATION		ROTAT	Ż			20 30
		COMMON FRINT ANGREAMENEMENTSCOMESCOMESCO		RTN	2			70 30
		COMMON JTRJOATJ NTRAJ.TTRAJ(136).XTRAJ(136).	.YTRAJ(100), ZTPAJ(100),	TACLAT	2		32	CONT
	•	LAWITY (1321) LARTYV (1621) LARTXV (1621) VZTWAJ	(1633,TMPTPJ(1603,	TACLAT	3			K . NN
	•	# # # # # # # # # # # # # # # # # # #	(100),ROT94J(100),	TAPLAT	4		43	CONT
	•	PTPAJ(100)		TRUPAT	•			32-3
		INGTOIL LIUN		SIENDAT	2			31 • J
		COMMON /SUNDAT/ LSUN, XTPAJS(100), YTRAJS(100		SUNTAT	,			
	•	RTRAJS(100)+AZANG+POLANG+RX	1,971,971	SUNDAT	4			TF (
:				ROTAT	6			1 F (
:				ROTAT	7		•	•
		** ** ** ** ** **		POTAT	•			1 . (1
		TE (IND.LT.C) 53 TO 100		ROTAT	. •		2,1	CONT
		**************************************	****	POTAT	16	_	60	15 (
		TRANSFORM TRAJECTORY AND FREESTREAM B-	FIELD CODEDINATES	ROTAT	11	ç		
		TO SOLAR WIND COURDINATE SYSTEM		ROTAT	17	Ċ		THTE
		758817-171900 0174170		FOTAT	13	С		
		TEMPA7-A7ANG+.G1745329 TEMPGL-POLANG+.D1745329		POTAT	14			SINC
		TEMPUL=PULANG+,31743329 SA7=STN(TEMPAZ)		ROTAT	15		73	BIME
		5A7=514(1E44AZ) CAZ=COS(TEMPAZ)			16			PRIN
		casacut (seabas)		POTAT	17 19	_		PETIT
		CPOL=CGS (TEMPOL)		POTAT	19	c		135E
		ng 1 I=1,4TRAJ		ROTAT	Şč	ć		./36
		TRAJS([)=XTRAJ([)		POTAT	21		101	CONT
		YT#435(T)=YT#43(T)		ROTAT	22			Ic (
		7TRA15(T)=ZTRA1(T)		POTAT	23			PPTN
	1	CONTINIE		POTAT	24			RETU
		90 2 [=1,4TRAJ		POTAT	>5		113	00 1
		XTRAJ(I) -(XTRAJS(T)-CAZ-YTRAJS(I)+SAZ)+C+OL	J042+11)2LAPT+	ROTAT	26			7F (
		YTPAJ(T)-XTRAJS(T)+SAZ+YTRAJC(T)+CAZ		ROTAT	27		123	CONT
		7TRAJ(11(FTRAJS(1)+CA7-YTRAJS(1)+SA7)+C+O	L+7TRAJS(I)+CPOL	POTAT	28		1 30	41.Y
		(I) LAPTX(I) LARTX		ROTAT	29			PTHE
		YTRAJ([)==YTRAJ(])		ROTAT	30			GO T
		CONTINUE		ROTAT	31			FND
:	-			ROTAT	32			
:		CALCULATE ANGU AND ANGP		RUTAT	33			
:		·		ROTAT	34			

		RX+(RX1+CA7-RY1+SAZ)+CPOL+BY1+SPOL	ROTAT	35
		9Y=9X1+SAZ+9Y1+CAZ	POTAT	36
		R7=-{9%1+C4 Z-8Y1+S4 Z}+SPOL+R71+CPOL 9%=-9%	ROTAT	37
		RYSERY	POTAT	3 P
		ANGP-ATANZ(BY,BX)	POTAT	46
		AMGM=ATENZ(87,5QRT(8x+9x+8y+8y)	ROTAT	41
		RTDD=57.29578122 ANGP=ANGP=PTDD	ROTAT	42
		ANGN-ANGN-R TOD	POTAT	43
		<b>RETITON</b>	ROTAT	45
ç			ROTAT	46
Ċ			ROTAT	47
٠	100	CONTINUE	POTAT	49
		PETURN	ROTAT	90
		EMU	ROTAT	51
		FUNCTION REINF((,))	PRIME	z
C			RRINF	3
ç		THIS ROUTINE CALCULATES PARING AT THE (1.19 GRID POINT	RRINE	•
C		COMMON /MOUNDS/ XMOD(130),YMOD(100),XSHK(130),YSHK(100),	RRINE	5 2
		• NRMAX-NYMAX-AMACH-GAMMA-HRO-NHTNDX	BOUNDS	3
		COMMON /FLOW/ XC(20,100), YC(20,100), YF(20,100), RHOF(26,100)	FLNY	?
		LEVEL 2, XST, YST, NUMST, MST COMMON /STPEAM/ XSTESC, 152), YSTESC, 152), NUMSTESO), MST	STREAM	2
c		COMMINA AZINEMUS YZITAGENĪASINISTONISTAS NAOMALITAGINASI	RRIME	4
¢		TE POINT IS ON SHOCK BOUNDARY RIRINF-1.6	RRIME	10
¢			RRINF	11
		IF (I olt. MAMM .ANO. J off. 1) OF TO 10  REINFOLD	RRINF	12
		RETURN	RRINE	14
C			RRIME	15
c		RPACKET POINT BY TWO STPEAMLINES	RRINE	16 17
٠	11	CONTINUE	****	16
		x+xc(1,1)	BRINE	19
		A=AC([*1]	RRINE	Şū
		92+0.0 nn 2: J\$T+1,H\$T	RRINF	21
		NN=N1457(J57)	RRTHF	23
		on so weller if (vst(Jst,k) .gt. x) on th 40	PRINE	24
		IF (YST(JST,K) .GT. X) 69 TO 40 CONTINUE	RRINF	25
	32	KNN CONTRACTOR CONTRAC	RRINE	27
	43	CONTINUE	RRTHF	20
		J2-J5T	RRINF	29
		J1=J5T=1 01=02	RRINF	30 31
		TF (K .Es. 1) 42-421(12-1)	RRTHF	32
		TF (K .GT. 1) K2=Y5T(JZ,K-1)+(X-Y5T(JZ,K-1))	RRINE	33
	•	• • • • • • • • • • • • • • • • • • •	RRINE	34 3:
	2.1	CUNTIANE	BEINE	36
		1F (J2 .60. 1) 40 TO 100	ROTHE	37
č			RRINE	30
c		INTERPOLATE FOR RIPTINF	RRIMF	3.9 40
٠		91Mc1=YST(J1,1)	RRINE	41
	73	PINE2-441(12,1)	RRINE	42
		#RTMF=Y/(#TMF1+{#TMF2-RTMF1}+(Y-R1)/(R2-#1)) #FT11RM	RRTHF	43
c		7610-4	RRINE	45
C		USE SYMPETRY AXIS AND BODY FOR ZERO-TH STREAMLINE	BRIWE	46
Ç		ADMITTANE	RRTHF	47
	103	IS (K .et1.0) 60 TO 110	rr inf rr inf	49
		9PTWF-1.0+Y/92+(92/YST(1,1)+1.0)	RRINE	90
		RETURN	ROTHE	51
	113	DO 120 K-2, NYMAY	RRTNF RRTNF	5.2
	123	TF (X ale. XC(1,K)) GO TO 136 CONTINUE	BEINE	53 54
		PI=YC(1,K-1)+(Y-XC(1,K-1))*(YC(1,K)-YC(1,K-1))/(XC(1,K)-XC(1,K-1))	RRTHF	55
		PTNF1+0.0	RRIMF	56
		GD T7 70 FND	PRTHF	57 58
		r TU	** 1 10 5	7.5

	CURROUTING SERCHEJ, K., KOD2, A., JOTH, ICHK, NKY, KOD3, NYAL, A.1, A.2, ACONT)	55904			****			
ç		SERCH	í		CALL PLOT(1.5,0.0,-3) YS-X5F	SETUP SETUP	40 41	
è	CONTOUP PROGRAMS PAP, VALK, SERCH, ENTER, AND CHECK WITTEN BY RESE SURENSON, MASA-AMES RES, CTR., AUG., 1974.	SERCH	•		42=42E	SETUP	42	
C	(4001FIED VERSION)	SERCH	?	c	CALL SCALFERS, Y*, 1)	SETTIP	43	
ć	THIS SURROUTINE CHECKS WHETHER A CONTOUR LINE AT LEVEL NVAL	SERCH	7	ċ	DRAW Y-AXIS	SETUP SUT32	44	
ç	PASSES THROUGH AN INTERVAL HAVING INDICES LEW AT TIME	SERCH	•	C	HTC-INTEYMAX)+1	SETUP	46	
c c	feet(kunz-5) Od BOLLUH(kunz-1) bolint.	SERCH	10		TALL AVISTO.O.O.O.IH .O.VLNGTH,-NTC.2,FTZ1	\$6109 \$6109	47 48	
	THEMSON ACCOUNCES, SCHECKIS	SERCH SERCH	11	E C		SETUP	75	
C		SERCH	19	č	LAMEL X-AYTS	SE TUP	50	
c	ILEA(19m)=1e(K-1)=1uIW	SERCH	14		YCH=4/YSF	5610e 2611e	51 52	
	50 TO (1,21,K002	SERCH Serch	15 16		XCH=0,5**XMAX=,75=,21/XSF TF (IMDPY,60,1) 60 TO 2	SETUP	53	
:	Totosy(J)Wolf	SERCH	iř		CALL CHARLACH ACH DOC 10 10 5	5ETUP 5ETUP	5 4 5 5	
2	T-IDEX(J+), K1	SEPCH	14 19		GT TO 3	SETUP	56	
3	42-4(1)	SERCH	20		PALE CHAREVEH, VCH, U.C., 14,3HX/P,39	\$E719 9UT32	57	
	T=T9EY(J,K) Al=A(T)	SERCH	51		CALL CMARIXCM, YC4, 0.0, .05, 1HO, 11	SETUP	5 e 5 e	
c	- 1-	SERCH.	22	c	3 CONTINUE	SETUP	60	
4	TF(41-42)4,5,5 44-42	56004	24	c	ANNOTATE Y-AYIS - MOTE ANNOTATION IS POSITIVE LEFT.	SETUP SETUP	61 67	
	A(+A)	SEPCH	25 26	C	YY==+15/Y\$E	SETUP	63	
5	CO TO A AMAAT	SEBUH	27		4xe0	SETUP	64 65	
•	AL-A2	SEPCH	2 A 2 O		YY-1,5	SETUP	66	
ç	WAA	SERCH	3r		S DELX-FLDAT(IX)+C.9 YOX-XX+DELX	SETUP SETUP	67	
•	VAL=ACONT(NVAL) IF(VAL-1T-AL) ON TO 12	SERCH	31		CALL WIMPLT(YDX, YY, John-O.1, -YDX, 1)	SETUP	5 P	
_	TECVALAGIAN) 60 TO 12	SERCH	33		TY=TY+] TF(YTY+LT=XPAX) GO TO 5	SETUP	70	
c	CALL CHECKETCHK, NKY, KONZ, J, K, NVAL, KONOS	SERCH	34	¢		qura? qura?	71 72	
	TF(KOO. EO. 2) GO TO 12	SERCH Serch	35 36	ç	ANNOTATE Y-AXIS AT SIDE EDGE OF PLOT	\$ETUP	73	
c	K003=1	4E9C4	37		YY=0.3	91/7 3 2 91/7 3 2	74 7=	
	Gn th 20	SERCH SERCH	38 30	:	> 44-44+1°C	SETUP	76	
12	K ∩ p 3 = 7 • ¢ T ∪ R V	SEPCH	40		YCH+-1.525/XSF CALL MUMPLT(XCH,YYu5/YSF,0.0+-0.1,YY+1)	SETUP SETUP	77 78	
26	FND	SERCH Serch	41			SETUP	79	
		36 74.7	42		TALL CHAR(TTIC, TY05/YSF, 0.0, .09, 14-, 1) [FETY-LT-YMAX] GO TO 10	SETUP	90	
				c		SETUP	91 87	
				C	LAMEL Y-ATTS.	\$ \$ T19 P	93	
_	SUBBOUTTHE SSTUP(IPLOT, THACH, GAM, IROSY)	SE TIJP	2	•	YCH==1.5=C.85/K <f< td=""><td>SETUP SETUP</td><td>94</td><td></td></f<>	SETUP SETUP	94	
č	THTS THUTING ESTABLISHES PLOT OPIGIN, DRAWS	SETUP SETUP	?		YCH=4[NT((Y44X-1.3)+C.5)+D.537/YS= TF (T430Y.FQ.1) 69 TO 12	SETUP	96	
č	AND LABELS AKES, AND WRITES TITLE.	S E TIJP	3		CALL CHAREKCHAYCHARACAAAAHRADAAA	SETIP SETIP	97	,
Ç .	<pre>'ICC PLOT SURPORTINES USED ARE PLOTFAXISFMUMPLTFCHARFSCALF,</pre>	91732 91732	•	,		SETUP	89	
Ċ	SATEK MATH, PLTEN, POTEN.	SETUP	7	•	2 CALL CHAREVEM, YFM, d. U, . 14, 348/8, 39 ************************************	\$51UP \$61132	90 91	
c	DIMENSION TITLES(2),TITLE4(2)	CE TIP	9		CALL CHAR(XCH,YCH,O.O.O.,O5,1HO,1)	SETUP	45	
	DT4E4STAN TITLE9(2),TITLE6(3).TITLE7(2),TTTL94(2)	SETUP	16 11	c .	CONTINUE	\$2 Tile 90T 37	93	
	DIMENSION TITLEF(2)	SETU*	12	Ç	DRAW TITLE. IPLOT DETERMINES WHICH TITLE	SETUP	05	
	COMMON /SCALE/ MSF, MSF, MMAX, MMAX, MLNSTH, MLNSTH DATA PTZ/1.57079633/	SCALE	? 14	Ç	SHOULD RE DRAWN.	SETUP	95	
	TITLE1,TITLE2/PHVELDCITY,,BHDE4STTY,/	SE TU=	jř		YCH=Y44X+C. 8/YSF	SETUP	97 98	
	DATA TITLE3(1),TITLE3(2)/1045TREAMLINE,145/ DATA TITLE4(1),TITLE4(2)/134TEMPERATUR,146/	SETUP SETUP	16 17		YCH==1.5+0.45/X4F If(TPLOT.E0.2) GO TO 15	ŠĒTUP	99	
	PATA TITLES (11, TITLES (21/10HCPAPALLSL , 10HP3HFHT)/	SE TIIP	ie		TF(TPLOT-F0-3) 60 TO 20	SETUP SETUP	104 131	
	TATA TITLES(1), TITLES(2), TITLES(3)/104(PERPENDIC, 1544)LAR CHMPH,  1 SHNENTS/	SETUP SETUP	10		IF (IPLOT.E0.4) 60 TO 14 IF (IPLOT.6T.4) 60 TO 21	SETUP	162	
	DATA TITLET(1)-TITLET(2)/13H(NOPHAL CO-10HHOOHENT) /	SETUP	23 21	c		SETUP SETUP	103	
	PATA TITL56(11, TITL56(21/104MAGNETIC F.SHTFLD./	SETUP	2.2	c	VELOCITY PLOT	SETUP	105	
c	NATA TITLES /94CONTOURS/,TITLEF(1),TITLEF(2)/124FIELD LINE,145/	SE TIP SE TIP	23 24		CALL CHAPINCH, VCH, O.C., 20, TITL 51, 9)	SETTIP	176	
ç		SE TIIP	25		*CH=XCH+Z4/XSF	4 € £110 € £110 €	107	
ć	SET ORIGIN AT LEFT END OF X-AXIS	SETUP SETUP	26 27		CALL PLTLM(XCH, YCH, YCH, YCH+02/YSF) CALL CHAR(XCH+005/XSF, YCH+00-02, 1HY, 1)	SETUP	139	
-	CALL PLOT(U.d),1.d,-3)	SETUP	26		104110440577136	9 711P 4 UT 3 2	116	
	X20X2E X20X2E	9 TUP	20 30		CALL CHARIXCH+009/XSF,YCH+02/YSF1 CALL CHARIXCH+009/XSF,YCH+000,02,2H/V,>1	SETUP	112	
_	CALL SCALFERS, YS, 11	SETUP	31		"ALL "ATHIXCH+G+4/X5F,YC4-,05/Y5F,,15/X5F,D,3,15)	98732 98732	113	
Č	DRAW AND LAREL X-AXIS. NOTE THAT SURROUTING AVIS	SETUP	12	c	60 TO 25	SETUP	115	
Ċ	REDUIRES PARAMETERS IN INCHES, NOT USER UNITS.	SETUP	3? 34	Ċ	TEMPERATHRE PLOT	SETUP Setup	116 117	
С	MTC-ENT(2.0+(XMAX+1.5)+1.0)	SETUP	35	c ,	CONTINUE	SETTIP	114	
	CALL ATTS(0-3-3-3-14 ,0,xtM6T4,-4TC,1,0-0)	SETUP SETUP	36 37	•	CALL CHARCECHATCHADOLAGEO, TITLE 4, 223	SETUP SETUP	119	
ç	SET PERMANENT ORIGIN AT X=0	SETUP	38		¥EH=¥CH+2.4 /¥SF	SETILE	121	
	TET TETTRACAL UKINEM AL SAU	SETUP	3+		CALL CMAPEXCH, YCH, 00-0, 02, 3MT/T, 3) CALL MATHEXCH+0,55/XSF, YCH+0,05/YSF, 015/XSF, 000,15)	SETUP SETUP	122	
						36.00	143	

SFOFE

Control		TE (TTRAJIT) .GT. FMAX) FMAX=BTRAJIT)					
		ino contrast	\$50EE	67	60 TO 4 STE	<b>OUT</b>	28
			25055		\$77	(WIT	29
1	•	- City and the lab		70			
Control   Cont		FIND PROFE OF MAGNITUDE			310		
		AL PRINTING			WRITF(6,611) K,KST(K,1),YST(K,1)	9110	33
### Annual Control   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100	•						
## 1 1 CONTINUE OF THE PROPERTY OF THE PROPERT		FL TG-ALOGIO (FOTFF)			WPITE(0,631) (XST(K,J),YST(K,J),J=1,MN)		
State   Control   Contro					II CONTINUE STO	CH) T	
Communication of Payer of 10 Trees als age of 10 Trees age of 10 Tre	c	** (FLNG .LT. V.G) WLDG-WLDG-1		78			
### ATTENDED   15 Per   1	c	FIND INCREMENT AS POWER OF 10 TIMES AT . 2. OR .5					
Transport   Tran	c				4 CONTINIE STO		
		16 (40) cc		92			42
No.   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100		47EL-0-2					
### ### ##############################		N4 = NL 3G			3 Y57(K,J)==X57(K,J)		43
		so to 740			RETURN		46
				97			
### ### #### #########################		ADFL-9.f			T //134,13,23H STREAMLINES CALCULATED) STR		13
72. CONTINUE  ***CONTINUE*** **CONTINUE*** ***CONTINUE*** ***CONTINUE*** ***CONTINUE*** ***CONTINUE*** ***CONTINUE*** ***CONTINUE*** ***CONTINUE*** ***CONTINUE** ***CONTINUE*** ***CONTIN					510 FORMATC////154 STREAMLINE NO.612.194. CTAPTING AT X/D D.FR.4. STr	OFF	50
ALLOGIA  ***********************************	,				- 27, -17, -97044) - 31r		
	•				4 9Hp 8/80 mp8441		52
T.	_	4 A = 4L DG + 1			t20 FORMAT(134,234(CORRESPONDS TO THETA		
## ## ## ## ## ## ## ## ## ## ## ## ##	7	'4) &10%=10,00% A		95	* 5447/O =,F8.4,1H))		55
VALUATE SCALE AND SPESST		ANEL-ANEL-ANEL-ANEL-ANEL-ANEL-ANEL-ANEL-			TUPTARILISAS ESPECIALES PUNDS TO THETA ##F6+2,944 DEGREES,#2X# STO		
TOTAL   TOTA		MA=G			630 FORMAT(/157-314/00-274-3460-2404-630-6-3-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-3-4-5-5-3-4-5-5-3-4-5-5-5-5		
C   CALCULATE SCALE AND OPESST   SEGRE 100   STORT   SEGRE 100   STORT   SEGRE 100   STORT   SEGRE 100   STORT   SEGRE 100			SEGEE		621 FOPMAT(/15x,44x/RC,11x,44R/RO/(9x,F13,4,5x,F10,41) ST	MJT	
CALCULATE SCALE AND OPESET   COME   137   CONTROL   COME   COME   137   CONTROL   COME	c ′	24 dilatinis			FHn STr	MIT.	60
		CALCULATE SCALE AND DERSET	-				
Transferrorror   Transferrorror   Transferrorror   Transferrorrorrorrorrorrorrorrorrorrorrorrorro	c	******		103			
### HEAT HOLD AND AND AND AND AND AND AND AND AND AN		4814203 TE TERTH .LT ( 03 BETHAL A.3 OF. /		304			
### ###   197   C		MMIN-INT(FMIN/(ADSL #A20N)-845N)					2
### THE TIME ALTS, and managers around no managers		P444-1-7-UE-6			C STRUCTURE TAXES CALCIN ATES THE SCALE GASTER AND DEFECT FOR TAX		
######################################		MMAY= 147 (FMAY) (ADEL +A164) +B4AY }					
######################################		ANTHORI DATE MAINIOADEL			T WHEN MAYISHID THE TIME AXIS IS PLOTTED TAN	¥TS	6
FEST-NETTED   12   12   13   14   15   15   15   15   15   15   15		SMAY=FL 7AT( MMAY) PADEL					
Continue		FDFFTT=4MTW+A10M/FTWF		112	* VT*AJ(100), VXTRAJ(100), VYTRAJ(100), TTRAJ(100), TTPRJ(100), TT		
### STORE 115 C FIND THE RANGE AND INCERNENT REQUIRED TAXITS 10 FIND THE RANGE AND INCERNENT REQUIRED TAXITS 11 FIND THE RANGE AND INCERNENT REQUIRED TAXITS 11 FIND THE RANGE AND INCERNENT REQUIRED TAXITS 11 FIND TAXITS 12 FIND THE STORE TAXITS 12 FIND TAXITS 13 FIND TAXITS 13 FIND TAXITS 13 FIND TAXITS 14 FIND TAXITS 15 FIND TAXITS 1		CDET-TUSTEL (WHY HE HIM AND M)			* RTRAJ(100), BXTRAJ(1w0), RYTRAJ(10(), RYTRAJ(10)), ROTRAJ(10), TR	JOAT	Ā
### 110		FSF=FSF+F?NF			TR.		
Transfer   117			SERE	116			
TE MANTE CT. 1) GO TO 150   TAXTS   12		="1"	ZEUEE	117	C INCREMENT IS POWER OF 10 TIMES .12, TO .5 TAY		
CURROWITINE STOUT   STOUT   CURROWITINE STOUT   STOUT   CURROWITINE STOUT   CURROWIT		•					12
C   C   C   C   C   C   C   C   C   C					44412=:		
C   C   C   C   C   C   C   C   C   C					TMINoTTPAJ(1) TAY		
THIS CHARDITINE PRINTS THE STREAMLINES CALCULATED STORY 6 TIGHT CHARDITINES FROM STORY 5 TRIPS 6 TRIPS 7 TAKES 18 THE CHARDITINE FLOWST STORY 5 TRIPS 6 TRIPS 7 TRIPS 1 TRIPS		CURROUTINE STOUT	51017	,			16
THE COMPOSITING PREMIST THE STREAMLINES CALCULATED  (IN SLIMPOUTTING EQUIDS)  (IN SLIMPOUTTING E			TOUT		71.00- 41.001: 470.004		17
C CHMMN / MINISTY TMETA(22) PRO(120) PR	č	THIS SUPROUTING PRINTS THE STREAMLINES CALCULATED		4	NTI, DC=TNT(TLDG) TAI		
C   C   C   C   C   C   C   C   C   C					TE (TLOGELTEDED) NTLOGENTLOGE1	XI 2	25
######################################	-	COMMON INCUNTI THETA(25), RP(23,25), NPCUNT	BLINT				21
Level 2, v57, v57, w1057, w57   STREAM 2   STREAM 2   STREAM 2   STREAM 2   STREAM 3		**************************************					? Z
C   STREAM   STIGO   192   TTST   STREAM   STORY   STREAM   STORY   STREAM   STREA		I FVEL 2. YET. YET. WHIRET. MET			MA-NTLIG TAI	*1*	24
C		COMMON /STREAM/ XST(SG,192), YST(SG,192), NUMST(SG), NST		í	C. CONTOURS		
Taris   Tari							7.6
12		AZAENZE ZIOM UL XZI ŁOS ONIDOA			ADEL=5.0		
NAMHUMST(K)	•	or 2 K-1,NST					20
10   25-5M   57097   16   APER-16   TAXES   22					4. Counting		
C   STREAMLINES FOR MAGNETOSPHERE   STOUT 10   MANNES   MANNES   MANNES					ADEL=1.0		
C STREAMINES FOR MAGNETOSPHERE STORT 18 NAMAGE:  WRITE(66602) MST STORT 20 ADEL-ADEL-20.1 TAXIS 36  FERMINDE, ROLL BOT D I STORT 20 ADEL-ADEL-20.1 TAXIS 37  OF 10 K-1.MST STORT 27 ADEL-ADEL-20.1 GO TO 100 TAXIS 38  WRITE(66613) K, MST(K, 21,	c	£			MA-MTL/1G TA	XI S	33
C WRITE(6,602) NST STOIT 10 ADELADEL-03.1 WITE(6,602) NST STOIT 20 ADELADEL-03.1 WITE(6,602) NST STOIT 20 ADELADEL-03.1 WITE(6,602) NST STOIT 20 ADELADEL-03.1 WITE(6,602) WIT		STREAMLINES FOR MAGNETOSPHERE			141		
## ## ## ## ## ## ## ## ## ## ## ## ##	С				ADEL-ADEL-0-1		
07 10 Kel-MST WATTE(06613) KAST(K,21)-YST(K,21) TAXTS STOUT 23 ADEL-ADEL-ALD ADEL-ALD ADEL-AL		##!!C10+0441 #51 TF[M4[NOX_F0_1] ED TO 1			- A104=10.44NA Tai	YES	37
######################################		PO 10 Kelanst		27			
TAYES   TAYE							
WEITE(6,63D) (XST(K,63),9TS(K,63),9TS,NN) TAYTS 42 13 CONTINUE TAYTS 48				24	MAXIS=2 TA	XI S	41
1) CONTINUE		UPITE(6,630) {XST(K,J),YST(K,J),J+],N4)	STOUT		****		
		13 CONTINUE	71017		and the state of t		33

1 03	CONTINUE	TAXIS	45			
	AMIN-0.0	TAFES	46	7TRAJ(M)+ZTRAJ(M)+RPLMT	TRAJEC	91
	N#A X=0.0	TAYES	47	RTRAJ(N)=SQRT(ZTRAJ(N)=+2+YTRAJ(N)=+2)	TRAJEC	32
	IF (TMIN.LT.O.O) SMIN=1.0-1.0E-6	TAYES	4.5	13 CONTINUE	TRAJEC	33
	TF (TMAY.GT.D.D) BMAX-1.0-1.0E-6	TAXIS	49	25 CUNTINUE	TRAJEC	34
	AFTRST-AINT(THIN/(ADEL+AIDN)-BHIN)+ADEL	TAVES	50	C ROTATE ABOUT N-ANIS UNTIL 7-2-0	TRAJEC	35
	ALAST-AINTETMAX/CADEL+A10H1+8MAX1+ADEL	TAXES	51	c contract property on the contract con	TRAJEC	36 37
	"TICK-INTELALAST-AFTRSTI/ADEL+1.0E-61+1	TAXTS	52	ng iso N=1,NTRAJ	TRAJEC	36
	TOFFST-AFTRST-AION	TAKES	53	THETOATAN2(ZTPAJ(N), YTRAJ(N);	TRAJEC	39
	TIMESF=+LTS7E/4(ALAST-AFIRST)+A10N1	TAXIS	54	CTHET=COSETHET)	TRAJEC	40
	THEL-AMEL-ALUNOTIMESE RETURN	TAXES	55	STHET-SIN(THET)	TRAJEC	41
	* 5 1 0 × 4	TAXES	56	Y P= YTRAJ(N)	TRAJEC	42
Ċ	DRAW AXIS ONE INCH UP FROM PLOT SOUNDARY	TAYTS	57	YP=YTRAJEN}+CT4ET+?TRAJEN}+ST4ET	TRAJEC	43
č	Dane with full fact the ak thin stol allowers.	TAXIS TAXIS	58	7Peli _e 6	TRAJEC	44
` 181	. CONTINUE	TATE	59	c	TRAJEC	45
• • • •	CALL PIOT(4.0,-12.0,-3)	TAXES	50	C INTERPOLATE FOR FLOW FIELD	TRAJÉC	46
	CALL PLOTIS.3,1.0,-3)	TARES	61 62	c	TRAJEC	47
	CALL AKTSCO-DANGOALM A-TAPLTSTFA-MTICKATACATE	TAXIS	63	CALL IJTPAJ(XP, YP, T, J, QT, QJ, MFLAG)	TRAJEC	4.6
С		TAXIS	54	TF [MFLAG1 80,40,93	TRAJEC	49
Ċ	ANNOTATE AND LAREL AXIS	TAXES	65	4) CONTINUE	TRAJEC	50
ć		TAVES	65	PHI=FTOAJ(T,J,4NG) YTPAJ(H)=FTRAJ(T,J,VF)	TRAJEC	51
	YCH=_15	TAXES	67	POTRAJ(1) = TRAJ(1) J. PHOF)	TOAJEC	52
	TCH=3.3	PIXAT	6.	TMPTPJEN3=1:+EEGAMMA+1:33+3:5+AMACM++23+E1:2-VTR4JEM3++23	TRAJEC	53
	ACH+AFTPST	TAYTS	59	Canimada and an analysis of the contract of th		54
	nn 25 / Hele HTTCK	TATE	70	SPHIRSTMERHIS	TRAJEC	55 56
	CALL MINPLT (TCH, YCH, Laster, 1) ACH, 1)	TAVIS	71	ZHQQ+(H)LAGTV	TRAJEC	57
	TCH+TCH+TDEL	TAYTS	72	UYTPAJIN) - YTRAJIN) - THE T	TRAJEC	59
	#CH+TC++#UEF	TAXES	73	VZTP4 J(H) = VTP4 J(N) = SPH[ = STHET	TRAJEC	59
201		TAYTS	74	c	TRAJEC	60
	TO SHARTE SO SEED TO SEE	TAKES PIKAT		C THTERPOLATE FOR MAGNETIC SIELD	TOAJEC	61
	TF	TAVE	76 77	c	TRAJEC	57
	CALL CHARITCH, YCH, G.C., 14, 9HTEME 13, 93	TAYES	7.	*PARAT=FTPAJ(TpJpR*ARA)	TRAJEC	53
	CALL CHAPETCH+.61.YCH.3.C07.1HY.11	TAYES	• 9	75 (T .60. 1) I=2	TRAJEC	64
	YNA-FLTAT(NA)	TAYES	90	*PERPT-FTDAJ(I,J, 4PERP)	TRAJEC	55
	CALL WIMPLT & TCH+1+26+ YCH++11+3+0++(6+ YMA+-1)	TATES	• 1	AMUBHLELS TO THE TANGEN	TRAJEC	66
	DETI)PH	TAYIS	92	PST-FTPAJEL, J, PAME)	TRAJEC	67
? .	CONTINIE	TAVIC	Á3	<pre></pre>	TRAJEC	6.5
	YC4+5+(Pt TSZ6+56)	PIYET	94	#AIMED#UTHEUTHED	TRAJEC	59
	CALL CHAPITOH,YCH,Dolpol4e4HTEME,4)	TARTE	94	RYTHEP+CANCHISANGP+CTHET+SANGH+STHET	TRAJEC	70
	D É THR A	TAXTS	96	97ENFPOSANGNOCTHET-CANGNOSANGPOSTHET	TRAJEC TRAJEC	71 72
	ÉND	TAYES	97	SHIPP STANZ (RYTHEP, MX INEP)	TPAJEC	73
				ANGNOUNTANZ (AZTNEP» SORTIANTNEP» + RYTNEP» + 7 TNEP» +	TRAJEC	74
				CANGPP+CDS(ANGPP)	TRAISE	75
				cancop=ciniamger)	TRAJEC	76
				CAMGNP+CDS(ANGNP)	TRAJEC	77.
	SHAROUTTHE TRAJEC	TAVIEC	2	CANGAD=CIAL WACHD3	TRAJEC	7.
Ç		TRAJEC	3	# YP = CANENPO (CPHI + CANGPPONPARATOCPSI + SANGPPONPED PI)	TRASEC	79
ç	THIS SURROUTINE CALCULATES THE VALUES OF THE FLOW FIELD		:	TYP=CANCHPO (SPHIOCANGPRORPARATOSPEERSANGPRORRERPT)	TRAJEC	90
2	AND THE MAGNETIC FIELD CHAPONERTS ALONG A SPECIFIED	TRAJEC		979=5A454P#A402PT	TOAJEC	41
ç	LOTICIJAA	TRAJEC	6 7	#YT#J!N}=#YP#CTHST-BZP#STHST #XT#J!N}=#YP#CTHST-BZP#STHST	TRAJEC	82
•	LEVEL 2, SPARA, BPERP, BYORM, 54AF, SAMS	AC THES	ź	477743143=479+CTHET+9YP+5THET	TRAJEC	23
	COMMON /ACOMMON APARALES, 100), *PEPP(23, 133), SWORM(20,103).	850465	5	4149141414204444444444444444444444444444	TRAJEC	94
	* **AS(20-1-))-*ANG(20-100)	BEOMPS	Ĭ.	en 70 1.	TRAJEC	95 •6
	COMMON FRINT ANGRANGNAMECONIZED	414	,	e	TRAJEC	67
	COMMON /MOUNDS/ X500(100), Y800(100), X800(100), X54K(100), Y54K(100),	4711474	2	TOURSE TOURS IN THE TOURS TOURS TO THE TOURS	TOAJEC	9.6
	* NOGGY, NYMAY, AMACH, GAMMA, HRD, MHIMDX	87(1475	•	c	TRAJEC	80
	LEVEL 2, ANG, DATH, DEG	DRD	?	ED TONTINOF	TRAJEC	90
	COMMON /ORD/ ANG(20,100), DYTH(100), DEG	ባድቦ	3	VTRAJ(N)=0.0	TRAJEC	91
	COMMON /FLOW/ XC(20,103), YC(20,103), VF(20,173), RHOF(20,107)	Ef uA	,	POTRAJIN}=,	TRAJEC	92
	COMMON ATRIDATA MIRAL, TIRALILLADI, XTRALILLODI, YTRALILCUI, STRALILIDDI,	TR JDAT	2	Imple left = 0.0	TRAJEC	23
	. ALDATICATO PARENTE COOL ALTERNATION PARENTE COLUMN COLUMN AND AND AND AND AND AND AND AND AND AN	TOJDAT	3	0.001(4)1401XV	TRAJEC	94
	* %TPAJ(1001.RYTRAJ(100).RYTPAJ(100).%779AJ(100).%3TPAJ(1'C).	TRJOAT	•	VYTPAJ(N) = , où	TOAJEC	95
	+ PTRAJ(100)	TRIDAT		VITAJ(N)+, ad	TRAJEC	94
	LOGICAL LPLTQJ	TR COT	2	ATRAJENT=0.0	TPAJEC	77
	CUMBUN \100061 FORESTY SOUNT, ALME SHULKE LABORE SOUND	TRAJEC		AXTPAJ(M)+0.0	TOAJEC	78
С	LOSE (1-1) TAA-1:0-0:10-0:17-0-10:0-10:0-10:0-10:0-1	TRAJEC	15 16	977941{N}=3=0 977941{N}=3=0	TRAJEC	99
	+ +(0[*VAL([,]+1)*(1.C-0])*VAL([+1,]+1))*(1.C-0])	TRAJEC	17	en to lug	TRAJEC	130
c	- *************************************	TRAJEC	i	C . 1 136	TRAJEC	101
•	CANGN-COS(ANGN)	TRAJEC	19	C POINT IS REYOND BOW SHOCK	TRAJEC	102
	SANGH-STHEAMIN)	TRAJEC	20	C	TRAJEC	174
	CANGP + COS (ANGP)	TRAJEC	21	92. CONTINUE	TRAJEC	195
	SANGP - STN(ANGP)	TRAJEC	22	VTPAJ(N)=1.0	TRAJEC	106
C		TRAJFC	22	9719AJ(N)=1.0	TRAJEC	137
Ċ	CONVERT X, Y, T FOR TRAJECTORY FROM UNITS OF PLANET RADII	TRAJEC	24	TMPTRJ(4)=1.0	TRAJEC	100
Ç	TO UNITS OF IONOPAUSE NOSE RADII	TRAJEC	25	C.1-(M)LASTXV	TRAJEC	109
С		TRASEC	26	VYTPAJEN1=C.C	TRAJEC	110
	TF (PPLNT .EQ. C.3) 60 TO 20	TRAJEC	27	V7TRAJ(P)-J-J-J	TRAJEC	111
	DO 16 N-1, NTRAJ	TRAJEC	58	ALEMPTE	TRAJEC	112
	XTRAJ(W)=XTRAJ(N)=RPLNT YTRAJ(N)=YTRAJ(N)=RPLNT	TRAJEC TRAJEC	2 9 30	AXTRAJIN)-CAMGM-CANGP	TPAJEC	113
	***************************************			MYTPAJ(M)=CAMGM+SAMGP	TPAJEC	114

	92TRAJENJ+S ANGH	TRAJEC	115	WRITE(6,1700) AMACH, GAMMA, RIMF, YIMF, XO, RMOINF, YO, THPINF, ZO TROL		
c '	LOD COMTINUE	TRAJEC	116	4PTTE(5+1830)		61 62
Ċ	OUTPIT TRAJECTORY INFORMATION, AND CREATE PLOTS IF REQUIPED	TRAJEC	117 11*	TO BE NOT SHIP TRAIN TO ME TO	ÚT	63
C	CALL TRAIT	TRAJEC	119	ANGL - ALGE TO BE AND THE TO BE AND THE ANGLE ANGLE AND THE ANGLE ANGLE AND THE ANGLE ANGLE AND THE ANGLE ANGLE ANGLE AND THE ANGLE ANGLE ANGLE AND THE ANGLE ANGL		64
	IF (.WIT.LPLTRJ) SO TO 290	TRAJEC	120 121	AAUIH-AAIME		66
	CALL PLOTTP	TRAJEC	127	Y7DIM-VXTRAJ(N) OYINF TRP! RMOOT-PRIDHOCK) NATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR-MATUR		67
	CALL PLOTES 260 CONTINUE	TRAJEC	123	THE		68
	RETURN	TRAJEC Trajec	124 125	ADINO TRANSMINE TROUT	UT	70
	EMD	TRAJEC	126	AYDIM-AYTALIKH-ATIKF TRIM AYDIM-AYTALIKH-ATIKF TRIM		71
				R7DIM=R7TRAJ(N)+BIME		72 73
				WPITF(5,2236) NeTTRAJ(M)eVDIMeVXDIMeVYDIMeV7DIMeHDDIMeTMEDIME		74
				A DI AND		75
	TUBROUTINE TROUT	TROUT	•	IF (LSIN) GO TO TO		76 77
c		TROUT	3	PFTURN TROX		7.
Ç	THIS SURROUTIME PRINTS THE TRAJECTORY CORRDINATES AND THE FLOW FIELD AND MAGNETIC FIELD COMPONENTS ALONG THE TRAJECTORY	Temit	•	TRANSFORM OUTPUT QUANTITIES TO SUM-PLANET CHARDINATE SYSTEM TROU		79
c	AS TARLES WITH TIME AS THE REFERENCE QUANTITY	TROUT	5	C and an annual control of the state of the		10 81
C		TROUT	ř	73. CONTINUE TRIUE	ijŤ	42
	COMMUM JACAJ AMEP,AMEN,KBCON,RCON(20) COMMUM JACAJ AMEP,AMEN,KBCON,RCON(20)	AŢW	2	OO 75 N=1, NTRAJ TROI VTRAJSCH)=VTRAJSCH)=RPLNT TROI		43
	* NEMAX, NYMAX, AMACH, GAMMA, HRID, WHENDY	20 MIDS	Ž	THINGS TYPE STATE TO THE TOTAL STATE OF THE TOTAL S		54 95
	LOGICAL LPERUNALPRELALPRITALPRENNALPREALPLOTALTRAIALRETET	PROPT	ž	'(FAJS(N)=ZTTAJS(N)#PPLNT TBO		96
	COMMIN /PROPT/ LRERUN, LPRFL, LPRST, LPRCOM, LPRA, LPLOT, LTRAJ, LRSTRT	PROPT	3	75 CONTINUE TRO		17
	COMMON ATPADATA MERAJATERAJEJOCIARTRAJEJOJATRAJEJOCIA PERAJEJOCIA PERAJETORIA PERAJEJOCIA PERAJEJOCIA PERAJETORIA	TR JOAT	ž	TEMPRI-PRIANG+.01749329 Tem		90
	" "TRAJ(133):BYTRAJ(160):BYTRAJ(1C0):BYTRAJ(160):BYTRAJ(160):BYTRAJ(160):	TRUCAT	4	CA7=SIM(TEMPAZ)	ŰŤ	90
	• RTRAJIZOD) LOGICAL LPLTRJ	TRUCE	5	\$47=C05(T54947) T40; \$POL=\$IN(TEMPOL) Tem		91
	COMMON /TROPT/ EPLTRJ, RPLNT, VINF, RHOTNF, THPENF, 91HF	TROPT	?	CPOL=COS (TEMPOL)	-	92 93
	LOGICAL LSUN	SUNDAT	ž	TO BO N=2, NTRAJ		94
	COMMON /SUNDAT/ LSUN, XTRAJS(100), YTRAJS(100), 77RAJS(100),	SUMPAT	3	ALLEVIZENI=-CUSCOCOOF AXLEVIZENI-ZUSCALLEVIZENI-CUSCOCOOF ALLEVIZENI-CUSCOCOOF AXLEVIZENI-CUSCOCOOF AXLEVIZENI-CUS		95
	TERAJSCIOCI, ATRAJSCIOCI, ATRAJSCIOCI, RY1, RY1, RY1, RY1, RY1, RY1, RY1, RY1	TROUT	14	VY [ 4 3 ] [ N ] # 7 4 7 9 7 9 7 1 9 4 4 4 4 7 9 7 4 9 4 9 4 9 4 9 4 9 4 9		96 97
_	* BYTRAJS(100), RETRAJS(100)	TERRIT	15	A. (awaziralamaanni akrikWhimi+ChDfaAlidWhiM) teldi		a,
c	WATTE COMMOTER IN W 9 BL 10 4 CHARLES OF TAXA	TROUT	16	AXTEAJS(N)=-CATECPOLEBXTEAJ(N)-SATEGYTEAJ(N)-CATESPOLEBTTEAJ(N) AYTEAJS(N)=SATECPOLEBXTEAJ(N)-CATERJ(N)+SATESPOLEBTTEAJ(N) Tem		99
C	WRITE COURDINATES (E,Y,Z,R) AS A FUNCTION OF TIME, TH UNITS OF BOTH RG AND RPLANET	TPOUT TROUT	17 18			176
C		14001	iö	S3 CONTINUS	UT	102
	PMDSE=1.0 TF {RPLMT .GT. 0.0} PMDSE=1.0/RPLMT	TROIT	5.0	XOS=SAZOCPOLOXO—SAZOYO—SAZOSPOLOZO TROU YOS=Sazocpoloxo—Sazoyo—Sazospolozo trou		193
	WPITE(6,1000)	TRMIT TROUT	22 23	104-4-00F+X0+Cb0F+X0 1440 102-145-Cb0F+X0+Cb0F+X0 1460		174
	WPITE (6,1001)	Tenut	ž3	C ****		176
	WRITE(6,1100) RMOSE WRITE(5,1200)	TEMIT	24	THE COORDINATES (Y,Y,Y,R) AS A FUNCTION OF TIME TROPE	117	127
	ON 20 M=1,NTRAJ	TROUT	75 26	· C		135
	**PPLNT=*TPAJ{N}+RNJSF	TROIT	27	WRITE (5,1160) Tea	1) T	116
	YPPLNT=YTPAJ{N}+RNDSE *RPLNT=YTRAJ{N}+RNDSE	TROUT	2.4	1971 (6,2102) Tent		111
	920H9-11494 J(H)-20040 SE	TOPIT	29 30	WPTTE (6,1200) TRO		11? 113
	(M)LAPTY-TY	TROUT	31	DO 90 N=1+NTRAJ TROL	UT	114
	VRTTE(6,2333) N,TTRAJ(N),XT,YTRAJ(N),TTRAJ(N),RTPAJ(N),XPPLNT, - YRPLNT,ZRPLNT,RRPLNT	TROUT	32	ABATL2=ALMY72(N)+MNO2E LAGG ABATL2=ALMY72(N)+MNO2E		115
	2). CONTINUE	TOPIT	33 34	7PPLTS=2TP4 JS (N) PRNOSE Tem		116 117
¢		TROUT	35	PRPLTS=OTBAJS(N) ORNOSE TON	UT	118
C	WRITE BUT FLOW FIELD AND MAGNETIC FIELD COMPONENTS WON-DIMENSIONAL WITH RESPECT TO FREE STREAM	TROUT	36	YTS+XTPAJS(N) TRRI WPTTF (6,25-00) N,TTRAJ(N),XTS,YTPAJS(N),ZTPAJS(N),RTPAJS(N),XPPLTC TRO	UT	119
č		TRMIT	37 36	**		12C 121
	WPTTE(6,13UC)	TROUT	39	43 CONTINUE TROIT	ÚŤ	125
	WRITE (6,1341) WRITE(6,1400)	TROUT	40	C TRYS C WRITE FLOW FIELD AND MAGNETIC FIELD COMPONENTS TROS		123
	Welte(0,1500)	TROUT	41 42	C NON-DIMENSIONALIZED WITH RESPECT TO EPECSTREAM TROE		124
	DO 40 M-1,NTGAJ	TROUT	43	C Table 1		126
	WPITE(6,2100) NyTTRAJ(N), VTRAJ(N), VTRAJ(N), VYTRAJ(N), VYTRAJ(N), VZTRAJ(N),	TROUT	44	WRITE (6,1300) TRIV		127
	* ROTRAJENS-THPTRJENS-BTRAJENS-RETRAJENS-BYTRASEMS-BETPAJENS 40 CONTINUE	TROUT	45 46	WRITE (6:1403)		129
ţ		TROUT	47	WRYTE (6,1500) TROI	UT	130
C	WETTE OUT FLOW FIELD AND MAGNETIC FIELD COMPONENTS	TROUT	48	00 95 M-1, MTRAJ TOTO MPITE (6,2160) M,TTQAJ(M), VTRAJ(M), VXTRAJS(M), VYTPAJS(M), TQX		131
ç	DIMEMSIONALIZE BY IMPUT FREE STREAM VALUES	TROUT	49 50	mgr .cm>zlastva.cm;laste.cm>tententententententententententententent	• •	132
	SANGN-STHEAMEN)	TROUT	51	TRAIS(N) TRAI	UT	134
	CANGN-COS(ANGN)	TPOUT	52	95 CONTENUE TROI	UT	135
	SANGP=SIN(ANGP) CANGP=COS(ANGP)	TROUT	53	C WRITE FLOW FIELD AND MAGNETIC FIELD COMPONENTS TRIN		136
	X D= 8 T NF OČAN GŇ OCANGP	TROUT TROUT	54 55	C DIMENSIONALIZED BY INPUT FREESTREAM VALUES TRIN	UT	138
	YO-RIMFOCANGNOSANGP	TROUT	56	HATTE AL AGAIL		139
	ZO-RINFOSANGM VRITF(6,1300)	TROUT	57 58	WRITE (6,1002) TRO		14C 141
	WRITE (6,1001)	TROUT	39	VRITE (6:1604)	ruT .	142
	V# [ TE (6, 1630)	TROUT	40	WPITE (6,1700) AMACH, GAMMA, MINE, VINE, XOS, PHOINE, YOS, TRPINE, YOS WRITE (6,1701) AZANG, POLANG TRO	M) T	143
				awite sobitors stage and a teles	ry (	144

*e* • . . . .

MALLE (9:1872)	TROUT	145	CALL AXISED.O.O.O.IH .I.PLTSZEHTTCK.2.PTOMZ)	VANIS	20
70 100 N-1, NTRAJ	TROUT	144	the same of the sa	VAVIS	21
VOI == VTRAJENI = VINF	TROUT	147	C AMMOTATE AKIS, TO THE LEFT	AVXIZ	22
YXN[H=YXTBAJS(H)+YIHF	TENT	140	c		
AAD EM-AAAD VIS (NIOAL NE	TRINIT	149	TCH==25	23 x 4 X 5 X	23 24
VYDIN-VYTPA IS ENSOVENE	TRIPIT	15C	VCH==05	ZIXAV	25
PHIDTH-POTRAL(N) OR JOYNE	TROUT	151	ACH-A-4TH	VATES	67
THOUTHOTESTASTASTASTAS	TROUT		OU 30 M=1.MTICK		5.6
ADIM-ATPAJENI-BINE	TROUT	152	CALL MUMPLT(TCH, VCH, G.3,-C.1, ACH, 1)	VAXES	27 28
RYDE - AYTE AJSENIOSENE	TROUT	153	VC4-MC4-MCE	AVALZ	<b></b>
UADIM-UALDY 72 (A) OUT ME	Tenit	154 155	4CH+ACH+ADEL	YAYES	2 9 3 0
#ZNIM##7T#AJS(N)#F				ATAL	30
	TROUT	156	30 CONTINHE	AVXIZ	31 32
UPTTE (5,22UL) N,TTPAJ(N),VDIM,VYDIM,VYDIM,VYDIM,PHDDIM,TMPDIM,	TR (HIT	157		VARES	32
* ************************************	T9 (71) T	110	C LAREL AKIS, AND WRITE TITLE ON PLOT	AVALZ	33
TE (anti- Leutra) on the enc	TOMIT	150	Maria a a a a a a a a a a a a a a a a a a	VAYES	3.4
THE CONTINUE CARLINGS TO SEC	TROUT	150	VCH2+G+5+PLTSZE	AVALZ	35
	TROIT	153	TC4?=-9.8	A4 A4 <	36
C TRANSFORM COMPONENT DATA TO SUN-PLANST COMPOUNTES	TROUT	162	YCH-017575417	VAYES	37
•	TROUT	163	₹CH=Cun	ZIXAV	38
10 153 N+1,4TRAJ	TROUT	164	67 77 (110,126,130,140), LF	VAXTS	39
AXAN IINDAALANICIAD	1110 81	165	\$14 charland	> Jx by	40
AAIGV1(m)-AAIGY12(4)	Libuti	166	CALL CHARITCHE, VCHE, L	PARTS	41
YZ TRAJEND-YZ TRAJS END	TROUT	157	CALL CHAR(TCH, VCH, Jab, 2, 8HVEL(CITY, 4)	VAYES	42
AKINATEN TENTENTENTENTENTENTENTENTENTENTENTENTENT	TO MIT	15*	*C4+*C4+1.*	VAYES	43
4410 7 14 14 14 14 14 14 14 14 14 14 14 14 14	TROUT	150	60 TO 152	VAYES	4.4
RPTPATER=EMPLARTER	TROUT	170	159 CONTACTE	VATES	4.5
LEA CONTINUE	TROUT	171	CALL CHAR(TCH2,VCH2,F3,J,F3,Z,F14T,F1)	VAYES	46
ZOJ CONTINUE	TROST	1 *?	CALL SHARETOM, VCH, J.L., 2, 11475 MARRATURE, 113	VAVIS	47
9 F T198 4	TRIPIT	172	TCH-TC-4-2-4	VAYES	44
C	TROUT	174	SO TO TAG	VAVIS	40
1003 FROMATEIN1,52X,22HTMAJECTOMY CALCULATTOM/53Y,726_4433	TOTALT	7.75	12 CONTINUE	VATES	50
1001 FORMAT (5)X, BUHESOLAR WIND COORDINATE SYSTEMS	TROUT	176	CALL SPEEKITCHZ. VCHZ. G. 25. D. C. 171	VAVIS	51
13"2 FORMAT (5. X. 3GH(SIN-PLANET COORDINATE SYSTEMS)	TROUT	177	TELL CHARITES, VCH, O.C. 2, 740EHSTTY, 71		
11CU CORMATI///53X, 22MTHAJECTORY CODROINATES/53X, 22(_H-)	TROUT	17.	TCH=TCH+1.6	SAXAS	52
* //**********************************	TPOIT	179	60 TQ 150	VAYES	52
.2- : FOP MATE / / 44 - 144, 74, 44TEME, 97, 44Y/RL , 7X, 44Y/R , , 7X, 447/P" , 7X, 44P/RL,		180	(4) CONTINUE	VATIS	14 ##
* PY, OHY POPLANET, 24, 9HY PPLANET, 27, 9HT PRETTY 27, 24, 9HE POPLANET P	TROUT	111		PIXAV	
The state of the s			CALL CHAR(TCH2, VCH2, ( . 1, 1, 2, 2, 144, 1)	AVALC	5.5
13C. FORMATI/////36X,464FLOW FIELD AND MAGNETTS FIELD COMMONENTS ALONG, 114 TOAJECTORY/36X,57(1H-1)	TROUT	1.5	CALL CHAPETON, VCM, Jaby, 2, SANMAGNETTO PTELD, 149	ATXIZ	57
	TROUT	143	TCH+TCH+3+2	AVAL	5 *
14. · SUBMATIVESX 464 (AUH-DIMENSTUMATILE AA LALESATAM, LABA ANTRES)			1:3 CONTINUE	ATAL	4.9
15: - TOP MATE //44, 14N, 5%, 4HTT #2, 7%, 6HV/VINE, 5%, 7HVY/VINE, 4%, 7HVY/VINE,	TRMIT	1*5	CALL CHAPITCH-VCH-J-C1-24VS-2)	AVAIR	50
<ul> <li>4x2 44x4 file 5x2 f &gt; H643/6H3 file 2x2 fx + fx +4x +4x + x + x + x + x + x + x + x +</li></ul>	TRMIT	146	TCH=TCH++6	VAXIS	51
· 7484/-745,44,7494/8245,44,7492/8745/}	Lethil	1.7	C41+	V4 Y*5	51 52
15C) FORMATIVELY, 484(DIMINSTOWAL, USING IMPUT THTEFOLANETARY VALUES))	TROUT	188	" (t = = 0.7 . 70. LF.EQ.3) GO TO 361	Afalc	57
17LJ FREMATE/234,3GHTMTEPPLANETARY MACH HUNNER -, F7.2, EY,	TIM RT	140	7641+7e5	PTYAV	64
* ?9MINTEMPLANETARY MAGNETIC FIFLD/2,x+	TOPIT	19:	VCH1=0LTC7F+:3-25	VA YE *	45
* 30HPATTO OF SPECIFIC HEATS		1 21	CO TO (710,220,230,240).LCOMP	PTYAV	55
<ul> <li>F1C.3/20%,3JHINTERPLANETARY VFLOCTTY</li> <li>-,10f1J.3,74,</li> </ul>	てく ペリナ	192	· ·	PITAN	57
+ 13MY-COMPONENT *,E10.3/24X,	TEMST	193	\$ COATTAIN	VAYES	6.9
<ul> <li>3GMINTERPLANCTARY DENSITY ====================================</li></ul>	TO TUT	124	CALL SHARETCH VCHIPC UP . 24 I H CHACKTINE 1, 111	VATES	59
• 134Y-COMPONENT -+Eli-3/20%,	TROUT	195	CALL Pt TLM! TCM2-wassaVCH2-TCM2-vastsVCM2+vast	PITAV	70
<ul> <li>ZEMENTERPLANETARY TEMPERATURE =&gt;ELONGYTY,</li> </ul>	TR OUT	236	"ALL PLTENCT"H2+(-19,VCH2,TSH2+:_19,VCH2+ _2)	VATES	71
• 1347-COMPONENT -, 610.3)	TONIT	127	50 10 360	VAVES	72
IP1. TOPMATERLY, BUMAPEMUTHAL ANGLE #FF1 #3	TROUT	134	r	VATES	73
* FTCY. 30HPDLAR ANGLE **FT.1.31	TROUT	100	22: TONT NIE	PTYAV	74
14( - COPMATT//4X,1HN,5X,4HTTME,8X,3H/V/,3X,2HVX,QX,2HVX,GX,2HVX,GX,2HVX,	TOTHE	235	CALL CHARITCHI, VCHI, C.O., 14, 134(x+C)4PONENT), 17)	VATES	75
* %HP HP, 7%, 44TEMP, MX, 34/M/, 9%, 2HMX, 9%, 2 HMY, 9%, 2 4M7/%	TROUT	213	TALL [44F17547+0.13.VCH2-0.05.0.0.0.1.147.11	PATES	76
2363 FORMATC13+4434+F13+4+2654+F8+4+3634+F8+4113	TROUT	1 2	50 70 300	PIVAN	77
21 · FORMATE) %: 14: 1x; F13: 4; 1(3x; F9: 4))	TRAILE	203	6	VAXTS	7.
22.1 CORMATELY, 14,17, F13, 4,17, 1P1, E11, 3)	Temit	2.4	273 CONTINUE	VAVES	70
END	TENUT		CALL CHARFTCH1, VCH1, G.G., . 14, 13H(Y-COMPONENT) . 13)	Adale	4.
			CALE C44P(TC42+4-13+VC42-0-15+1+C-1+1+V-1)	VAYES	Ā,
			50 10 300	ATALL	
			37.44.300		• • • • • • • • • • • • • • • • • • • •
			24/ CONTINUE	VANTS	44
			CALL CHARLEGES - VEHI	VAVIS	24
	VAYTS	,	CALL CHAP(TCH1, VCH1, La), 124, 134(7+COMPONENT), 13)	AfAld	9.
SURPOUTINE WAXISCUSE, WOFFST, WINE, PLTSIF, LV1			CALL CHAP(TCH2+0.13,VCH2-0.05,C.0),C.1,147,11	AFAL	96
C	VAVES	•		PARTS	•7
C. SHAROUTING VAXIS CALCIDATES THE PARAMETERS PROVIDED FOR THE	VAXTS	•	C 470 LLANN SCALING FACTOR IN PROUIDIN	VAYTS	5.0
C VERTICAL AVIS FOR THE TRAJECTORY PLOTS. THEN DRAWS AND	PIXAV		303 CONTENIC	VAXTC	10
C LARELS THE AXIS. LY INDICATES FOR WHICH COMPONENT THE	VARTS	5	TE HA ED DA CO DE	VAYES	95
C ARIS TS PEGUIRED. IT IS ASSUMED THAT THE X-Y-7 COMPONENTS	VAXTS	?	IF (NA .EO. )) GO TO 350 TCH==0.90	VAYES	93
C THEOTATELY FOLLOW THE MAGNITUDE PLOTS. AND THE PARAMETERS	PITT			ATAIL	35
C APP MOT RE-CALCULATED.	ATAL	•	VC4+VC42-1,35	ATALL	93
c '	VANTS	10	CALL CHARCTCH, VCH, Journal 6, 147, 17	44414	94
PATA PIONZ/1.5767963/	PIYAY	11	"#IL CYPRITC++CaRMaVCHaAaDa3a12a2413a21	VATES	95
c	VAYTS	1?	*C4+5C4+0+3C	ATTAC	a 6
C CALCULATE PARAMETERS, THEN DRAW AXIS WITH TECK MARKS	ATALZ	13	YNA-FLOAT(NA)	77 Y A V	97
c	VAXTS	14	CALL MUMPLECTCH, VCH+.11,0.0, .36, XNA,-11	VAVIS	9.8
LF-LY/1	STYAN	15	35% CENTIAGE	AAXIZ	99
(COMP-(V-12,-LF+1	PIYAV	16	₽ E TU• N	VATIS	176
1º ([C740 .6T. 1) GD TO 13	AFAEL	17	ĖNO	VAXTS	101
CALL REMFFELF, VIMF, PLTS7E, VSF, VOFFST, WA, MTTCH, AMEN, AMEL, VRELT	VAXTS	ī.e			
12 CONTENUE	AVALZ	19			

```
FUNCTION VINTRPIXATE
 WINTER
 KK (2) = K - 1
 WALK
 VINTRA
 KK(3)=4-1
 VALK
 41
42
 THIS FUNCTION INTERPOLATES FOR V AT (X, V) FROM THE GRID VALUES
 VINTER
 15
 K5(1)+1
 VINTRO
 42121-2
 WALK
 COMMON /REUNT/ THETA(25), PP(22, 25), NULINT
 COMMON %FLOAN, KCIS$*1031*ACLS3*1303*AELS3*1303*AZHK(1303*

- M&HAL*MAKHYYMWCHPQWHWHAD*MAMDO*AHK(123*AZHK(1303*AZHK(
 ROIMOS
 60 TO 14
 WALK
 45
46
47
48
49
56
 901405
 WATK
 FL DV
 TENTATION 41 TO THE LEFT
 WALK
 9ATA 926/57.29578/
 JJ(1)-J-1
 -
 VALK
 THET. ATAME - Y/X1 - DEG
 VINTER
 10
 11(5)-1-1
 WATE
 VINTER
 JJ(3)+J-1
 TO 15 NT=2+NALINT
TECTHET-LT-THETACHTEE GO TO 23
 VINTER
 KK(1)=K
 WALK
 51
 VINTER
 KK 121 -K
 CONTINUE
 13
 VINTOD
 KK(3)*K+1
 WALK
 53
54
 14
15
16
17
19
 2. P.SOPTEYON-VOVI
 VINTER
 16
 F>(1)=?
 JIHEL#(IMELVENI)=IMELD\(IMELV(HI)+IMFLV(MI-;))
##70#16*#######
 VINTER
 ¥2121e1
 55
56
57
58
 PP2=DT4ET+4P(1,NT-L1+(_.J-DTH=T1+4P(1,NT)
 WALK
 VINTRE
 42(3) •2
 WALK
 TO 33 HERP, HEMAY
 VINTER
 PP2=DT4:T+RP(N0,NT=1)+(1,+-DT4ET)+0PP(N0,NT)
 WALK
 SEARCH THE 3 POSSIBLE DIRECTIONS.
 TF(9.17.PP2) G9 T9 46
 59
 26
 WALK
 CALL SEPTHE JICHI, KKEMI, KZEMI, A, JOTH, TTHK, NYY, KIENI, NYFE, ATENI,
 17
 VINTER
 WALK
 31 CONTINUE
 VINTER
 DR-[PPZ-R]/(RPZ-BP1)
 22
 WATE
 61
62
 c
 VINTRE
 VINTOOA(DTMETOYFCHR-1,NT-13+(1,C-DTHET)OVFFMP-1,NT)JOHR

OCTUTETOYFCHR-1,NT-13+(1,C-DTMET)OVF(NB,NT)JO(1,C-HB)
 VINTRE
 #35=K3f1)+K3(2)+K3(3)
 WALK
 63
64
56
56
57
57
77
 VINTER
 25
 TF(#35-1)1, 2, 19
 VINTER
 26
27
28
Ica Pav
 RRANCH PRINT
 VINTER
 ON ICO MEMBERNE MEMARY
 WALK
 TERRENDS).NE.11 50 TO 9
 VI UTO 0
 16
 WALK
 TELY-LT- XC(1, HT3) 50 TO 120
 VINTOR
 30
 MAIK
1: CONTINUE
 VINTRP
 CO TO 4
 WATE
 HT=NYMAY
 VINTER
 31
 WALK
12. THET=(YC(1,NT)-X)/(XC(1,NT)-XC(1,NT-1))
 VINTOR
 DNS THE DNG DUT. FIND WHERE DUT.
 71
72
 WALK
 001-074576476(1, NT-1)+(1.6-0745716476(1, NT)
 VINTRE
 VINTOP
 TECHS(#61.EQ.1) 60 TO 4
 73
74
75
 4414
 PPZ-9744T+YC(NR,NT-1)+(1.C-9745T)+YC(NB,NT)
T=[R.LT.PPZ] G9 T9 42
 VI "TRP
 VALK
 34
991=092
13, CONTINUE
 RECORD THE POINT
 VINTER
 37
 WATE
 76
77
7*
 VINTER
 CALL FATEPERSTERS JJEKS D. RKEKS D. VVAL. AT (KS). ASTRAS, JATA, KATA, TOHK,
* KONS, XOY, NXY, ACONT, TST713
 BETHON
 VINTOR
 39
40
 WALK
 VINTER
 79
 RESET J AND K
 WALK
 14311141
 91
92
 MAIR
 MATE
 43
84
 SEE TE METPE AT A BOUNDARY. IF SO, OUTT.
 CURROUTINE WALKIKODS, J. W. A., FOIM, ICHK, INTN, INAY, KMIN, KMAY, WONG,
MXY-ACONT-KODS, X, Y, NYAL, TCTTII
 16(J. 67. JHIN) 67 TO 23
 MALK
 WALK
 2
 en TO (26,19,24,23), KODS
TETJ.LT.JMAN) GO TO 19
 96
 PIAV
 WALK
 23
 WALK
 WATE
 CONTOUR PROGRAMS MAR, WALK, SIRCH, ENTIRE, AND CHECK WRITTER AV REESE COREVESOW, MASA-AMES RIS. CTP., AUG., 1974. [MODIFIELD VERYORM]
 99 TO 124,25,26,191,8905
 WALK
 55
 24
 TF(#5.60.3) 69 TO 1
 WALK
 MAIR
 MAFK
 91
 WALK
 25
 TF(#6.50.2) 60 TO 1
 MELM
 WALK
 GIVEN THE BOTHE OF A LINE, THIS SURPOJETHE HALKS APRISON
 WALK
 92
 WALK
 THE PEST OF THE LINE, RECORDING THE REST OF THE LINE.
 26
 TEEN4.FO.11 ER TO 1
 WALK
 93
 WALK
 11
 WALK
 OTHENSTON 4(1).TCHK(4,1),ACONT(1)
OTHENSTON K3(3),A2(3),A2(3),J(3),KK(3),KK(3),K2(3)
 19
 IFEK.GT.KHEN) SO TO 27
 WALK
 95
 VALK
 50 TO (9,35,29,281,4005
 WALK
 WATE
 27
 IF(K.LT.KHAY) 60 TO 8
 VALK
 96
 WALK
 14
 60 TO (10.11.12.13).K005
 WALK
 TECES.E7.11 GO TO 1
 28
 VALK
 90
 VAIK
 16
 ORTENTATION 1: UPWARD
 WALK
 125
 VALE
 29
 1F (85.50.2) 57 T7 1
 13111-1
 WAIK
 JJ(?)-J
 WALK
 103
 10
 WALK
 36
 *FEK6.E0.31 GO TO !
 11(31-1+1
 WALK
 AK (.) PK
 WALK
 104
 21
 MARK
 PREPARS FOR NEXT STEP
 F# (2) +K+1
 WATE
 WALK
 22
23
 K034=4-K6
 WALK
 136
 WALK
 KUN5-KUN5+K6-2
 50 to 15
 WALK
 WALK
 *F(K005.6T.4) K005=K005=4
*F(K005.LT.1) K005=K005+4
 WALK
 WAIK
 129
 DRIENTATION 21 TO THE PIGHT
 WALK
 26
 างเก๋าร้ำ
 GO TO 31
 WATE
 111
 Ċ
 WALK
 MALK
 2 A
 9 CONTINUE
 JJ(3)-1
 WALK
 112
 WALP
 KK [] + K+]
 K005=0
 WALK
 VALK
 32
 RETIRN
 KK (3) = K
 VALK
 114
 WALK
 31
32
 WALK
 60 TO 15
 WATE
 33
 WALK
 34
35
 OFTENTATION 31 DOWNWARD
 WALK
 11(1)-1+1
 WALK
 36
37
38
 JJ(21-J
 WALK
 COMMONICOME JAMATE (J.K.) TO COMMONICOME JAMATE (J.K.) TO SMU, EPRT,
 11(31-1
 KK(1)-K-1
 39
 WALK
 > CHOPM, NCA, NCB, NCC, AA, H, OREGA, NU, NL, IT, TAU, TTEP, ENT, PTORT, PINF,
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NXII OF TO 65	TOURS OF THE PROPERTY OF THE P	TO AND THE TANK OF THE WATER OF THE WATER OF THE TOTAL OF THE TANK	SINILARIC NA	÷	C POTNT RODY AND SHACK LOCATIONS		174227 Dr. CC	サット オード・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア・ア	ALVITAGE COLOR COL	(FAGURSTARD #X94(NGURS)ARD #X94(AUUA)ARD AND AND AND AND AND AND AND AND AND AN	THE COMPTONE TO BE STANDED AND THE PROPERTY OF	Cossessitative olang and magains cons at Thetamot Decores	CI-XET OIL LEGITAL	ニードの コイトリング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コールング・コール	K # 2 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4 a K 4	を成りるはませい		PRESE OF PRESE	OKONTRESTORNO POLITICATION CONTRACTORNO OKONTRESTORNO POLITICATION CONTRACTORNO POLITICATION POLITICATION CONTRACTORNO POLITICATION POL	00000000000000000000000000000000000000	に対すがよりなりにするが、これのでは、		(	Manual Commence	A STANT TO SERVICE TO	TANDAL MANAGEMENT OF THE PROPERTY OF THE PROPE	0 * ( = -11 = 2 ) OO?	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<*! IFF. GIMF. GIMF. JCS. TR. CLUS. PT. HORM. RNOS F. HCASE. HPINCH LEVEL 2. XY PYSTY XES. XY EX. COMMON. COSZ. X (45.20). V(46.21). XET(43.20.2). YEX (40.20.2). * XET(40.20.20.20). V(40.20.).	CONFIGN (CONS) G(43244) EF (40.4) S (40.20.4) EC (4) ABI(4.4) CONFIGN SACRETAR MATRICS AT A GIVEN 3-K NODE POINT. A MATRIX IF I-1.	C s materix in 1e2.	**************************************	1 = 0 (7 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 4 ° 1 ° 1	VEG(Joke 3) ORI	Approximation of the state of t		BAC1921 44	AAC 19 30 0 7 7 4 P(19 4) 0 0 6 2	##	THE STATE OF THE S	AA-10011-270-57-V0T	ものでしょうしょ アイライー かんらん カーファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファーション・ファール・ファール・ファール・ファール・ファール・ファール・ファール・ファール	A STANDARD NA STAN	A A C A C A C A C A C A C A C A C A C A		Patruo				THOULAND MINATA	いっこうきつさべいこうしょうしょう スエカイン・フェック スエック・フェック・フェック・フェック・フェック・フェック・ファック・ストック・ストック・ストック・ストック・ストック・ストック・ストック・スト	COLNES DENES CINES LOS TRUCTOS PT. HORN, RUGSE, MCASS NOTACE NO UNITED	FV:L Zorry bastorioxistoritys   Comming	- XEV(4(5,23)-0(4)-2)-)	124417 101418 01418 1 419 ER(40+4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) - 2(4) -	THE THE TANK THE TO THE PROPERTY AND THE PROPERTY AND THE TANK THE	CHWAIN FELDET KCC20+1031+VCC23+1001+VCC2C+135+V440FC2C+1CC1	CAST *COST COST CAST TO A COST COST COST COST COST COST COST COST	COMMENTAL FORWARD BARDENSMENTS RAVIOUS INTERPOLITATIONS FOR CALIFORNIA CONTRACTOR CALIFORNIA CALIFO	THE THE COURT OF THE PROPERTY	Co. INTITALITY	Maire (5,227.1)  From a Trium, 15,2 15,2 2,4 2,1 11 11 11 11 11 11 11 11 11 11 11 11 1	TALAN INTE	NAME OF THE PARTY	シスピトトイプログ いトララシャー アー・ファー・ファー・ファー・ファー・ファー・ファー・ファー・ファー・ファー・ファ	10 10 10 10 10 10 10 10 10 10 10 10 10 1	LALL SAMPY	FALL MYERS	!	Catal mireures	Commence and contours, also wettten to taped and medium		20 10 the State Cartesian	CROCK(J)=+XEA(J)=XFAX=2)-/XEY(J)=XABX=2) JO Hollofigh	VOICE - 1) - M(-L) - 10-)	V ( K , J ) = 2 ( J , K , Z ) / 2 ( J , K , Z ) + F & C V

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C Cb.PFRFORM IMTEGRATION FROM / TO ANG DEGREES	BODY	93 84	15 • 1t +1 1 • 1t	STRI 9TRI	11 12
c c	8007	85	00 11 N+1,4	STRI	13
00 15 I=1, I MAXM1	BODY	86	nn 11 H=1,4	STRT	14
CPEDICTOR THETAISTHETA	900Y 900Y	87 98	11 H(N,M)+B(T,N,M) CALL LUDEC(H)	BTRI BTRT	15 16
P-81+DELTAT OG (81-THETA)	BODY	3	71 = V1+EF([-1]	BTRI	17
THETA-THETA-DELTAT	8707	96	02 = Y2+(EF(1,2) - L21+D1)	BTRE	18
Composition Competition  Quality 50ELTATO(G(R1)THETA11+G(R,THETA))	3007	91	D3 * V3*(EF(I,3) - L31*D1 + L32*D2)	STRT	20 20
6108	AG DY	92	N4 = V4+(EF(I,4) = L41+D1 = L42+D2 = L43+N3) EF(I,4) = N4	RTRT	21
15 CONTINUE	8007	94	EF(1,3) = D3 - U34+D4	RTRE	22
Y=2.n=R+Cns(amg) Y=0+Sin(amg)	#IDA	9.5	EF(I,2) = D2 = U24+D4 - U23+EF(I,3)	ATRI	23
RETURN	577Y 800Y	96 97	EF(T,11 = D1 - U14+D4 - U13+EF(T,3) - U12+FF(T,2) 70 12 M=1,4	ATOT STRT	24 25
C	BODY	98	01 - V1-((1,1,4)	STRE	26
Consultanterpolate FROM USER-SUPPLIED BODY SHAPE	BUDA	9.9	02 = V2+( C(I,2,N) = L21+D1)	STRE	27
C 35 CONTENIE	RODY RODY	100	ns + vs+( C(1,3,4) - Ls1+D1 - 132+D2) n4 = v4+( C(1,4,4) -L41+D1 - L42+D2 - L43+D3)	STRT	58 58
70 39 T-2,4800	SODY	101 102	R(1,4,4) = D4	STRE	3 C
TF (ATAM2(YY(I), XX(I)) .GT. ANG) GO TO 4.	BODY	103	4(1,3,4) - D3 - U34+D4	RTRE	31
34 CONTINUE 49 91=5087674613+024X6130023	RODY	124	M(1,2,M) = D2 = U24+D4 = U23+B(1,3,M)	STRT STRT	32 33
*2-5QRT(YY([-1]**2+XX([-1]**2)	800Y 800Y	105 106	A(T,],M) = D1 = U14+D4 = U13+B(I,3,M) = U17+R(I,2,M) CFD+MARD SWEEP	ATRI	34
ANGI-ATAN2(YY(I),XY(I))	8004	107	12 CONTINUE	BTRI	35
ANG2-47ANZ(YY(1-1), YY(1-1))	MODY	105	00 13 I=IS, IU IR = I =1	ATRY ATRI	36 37
P=R1+(aMG-AMG1)/(AMG2-AMG1)+(R2-R1) Y=1.0-4+CD5(AMG)	9 7 DY 50 7Y	109 110	70 14 4-1,4	STRY	37
Y=STN(ANG)+#	9077	111	EF(I, M) = EF(I, M) -A(I, M, 1) *EF(IR, 1) -A(I, M, 2) *EF(IR, 2)	ATRI	39
PFTIJRN	MODY	112	• -A([•N#3]*FF([P#3] -A([•N#4]*EF(TR*4)	STRY	40
C	800Y	113 114	NO 14 H-1,4 M(M,M) - R(I,M,M) -A(I,M,1)+8{IR,1,M) -A(I,M,2)+8(IR,2,M)	STRT. RTRT	41 42
С	NO DY	113	1 -A(I,4,3)+9(IR,3,H) - A(I,N,4)+9(TP,4,M)	RTOT	43
45 CONTENIE	BUNY	116	14 CONTINIE	STRY	44
TF (4.LT.).11 60 TO 20	977Y 800Y	117 11*	CALL LYDEC(4) N1 = V1*EF(1,1)	STRT STRT	45
Cooo.b.PERFORM INTEGRATION FROM 3 TO ANG DEGREES	9337	119	72 - V2*(EF(1,2) - L21*D11	ATRY	47
c .	8704	120	73 • V3+(EF(T,3) - L31+D1 - L32+D2)	RTRE	4.6
07 55 I-ESTART, FRANKL AS-STRITHETAD	RODY RODY	121	74 = V4+(=F(T;4) = L41+N1 = L42+D2 = L43+D3) FF(T;4) = 74	ATRT ATRT	4 9 5 C
4C=CGC(TH\$TA)	RONY	122 123	EF(I,3) = N3 - U344N4	STOT	9ì
THETA1.THETA	BODY	124	FF(1,2) = N2 - U244N4 - U23+EF(1,3)	ATRY	52
Cb.PRENICTOR	⊕0.04	125	FF(T,1) = D1 - U14+D4 - U13+EF(T,3) - U12+EF(T,2)	STRE	53
4]==3{₹1,04} Kai	80 PY 309Y	126 127	16( ! - 10)16,13,13	ATRI ATRI	54 5*
984=F2(R],AS,AC,A])	BUCA	120	NO 15 M+1.4	ATDÌ	56
IF {PRY_LT_00_0} DRY=2_0H0AS0AC Pori+>0toletat	90 0Y	129	P1 + V1+C(1-1,M)	STRI	57
THETA-THETA-DELTAT	80 PY	130	02 = V2+( C(1,2,M) - L21+D1) 03 = V3+( C(1,3,M) - L31+D1 - L32+D2)	ATRT Birt	56 59
ASIOS (MITHETA)	RONY	132	74 = V4+( 5(I,4,4) -L41+D1 - L42+D2 - L43+731	ATRT	60
AC1=COS(THETA)	ROOT	133	RCT+4+H = D4	ATRI	51
CCORTINUE	40 0Y	134 135	#{T,3,M} + D3 - H34+C4 *{T,2,M} + D2 - H24+D4 - U23+B{T,3,M}	STRY STRY	62 63
4]1=F3(R,H)	RODY	136	n(1,1,m) = D1 - U14*04 - U13**(1,3,m) - U1?**(1,2,m)	PTOT	54
npvx=F2(R,AS1,AC1,A11)	970Y	137	25 CONTINUE	ATRT	6.5
TF (PRX+LT+0+D) PRXX=2++H+AST+ACT PLOPE++5+(DRX+DRXX)	4 7 D Y	138 139	13 CONTINUE Compack Substitution	STRI STRI	56 67
P-R1+SLNPF+DELTAT	80 DY	140	TT = {L + 1U	STOT	
Ya#+1	ADDY	143	00 21_TT = ISATU	RTRE	59
TF (W.LT.,5) ΑΟ ΤΟ 5υ V-1.Ω-904C]	RODY	142 143	f = 17 - 17 10 = 1+1	STRI STRI	70 71
Y+P+451	9707	144	70 22 No. 1.4	9781	72
1101	RODY	145	FF(ToN) = FFCToN) -961,00130FF(1Po1) -961,00,230FF(1Po2)	STRY	72 73
SS CONTENUS PREVION	907Y 900Y	146	+ -P(I,M,3)+EF(IP,3) -R(I,M,4)+EF(IP,4) 22 CONTINUE	TRI	74
5 NO	900Y	147 148	21 CONTINUE	97PT	75 76
		• • •	PETURM	RTRI	77
			FN)	9181	7.0
TURPOUTINE STRICIL, IU) LTVEL 2, Go EFo So 6, An	RT## COM3	2			
COMMON /COM3/ Q(4),20,4),EF(40,4),*(4),20,4),G(4),AB(4,4)	COP3	3	SHRROUTINE DISSIP	DESSEP	2
LEVEL 2, A,8,C,MD	COM4	ž	COMMONICOMI /JMAX,KMAX,JM,KM,XMACH,ALPHA,GAM,GAMHI,CN,DT,SMU,IPRT,	COMI	•
COMMON /COMA/ A(4),4,41,8(40,4,41,C(4),4,41,40(40,4,4)	<u>C</u> 7#4	2	> CHORD-MCG-MCG-AA-H-OMEGA, NU, NL-IT, TAU-ITER-ENT-PTORT-PINF,	COMI	9
P\$AL L11,L21,L22,L31,L32,L33,L41,L42,L43,L44 COMMON /LUD/ L11,L21,L22,L31,L32,L33,L41,L42,L43,L44,V1,V2,V3,V4,	LUD	3	<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	COMS COMI	;
<ul> <li>U12, U13, U14, U23, U24, II34</li> </ul>	LUD	Ā	COMMON /COM2/ X(43,20),Y(40,23),XET(40,26,2),XEX(43,26,2),	CDMS	3
DIMENSION MIGAGE	ATRI	6	• XEY(40,20,21,D(40,20)	COM2	4.5
C INVERSION OF BLOCK TRIDIAGONALOOD A,B,C ARE 444 PLOCKS C EF IS FORCING FUNCTION AND SOLUTION IS DUTPUT IN EF, B IS OVERLOADED	ATRI	7	LEVEL 2,9,6F,5,G,A9 COMMON /COM3/ Q440,20,41,EF(43,41,5(40,20,41,6(4),A9(4,41	COM3 COM3	7
C REDCK INVERSIONS USE NONPIVOTED LU DECOMPOSITION	RTRI	ě	CSMOOTH IN THE X AND Y DIRECTIONS AND ADD SMOOTHING TERM TO S ARRAY	013519	i
C IL AND TU ARE STARTING AND FINISHING INDICES	STRE	10	KMM-KM-1	012210	7

ina*la=1	DISSIP	•			
CSMIGTMING IN #1 DIRECTION	915510	9	P[=1,3/0(J,#,1) '!=0(J,K,2)++[	ETGEN	11
70 1 No.p4	Ulzzia	16	V=0(1)*(,3)**(1)	FIREN	12
2{5'x'n =2{5'x'n =2m +0"152+(-5")+0(5'x') +0(1'x')+2"0+0(5'x')	91221P	11 12	X1A=XEX{]***1} x1A=XEX{]***1}	FIGEN	14
P #N(2;K1-4,C+C(3;K;N)#D(3;K1+Q(4;K;N)#D(4;K15;JO(2;K)	STEETP	13	x1x=x2x(1)'x'1)	ETGEN	1.5
~ { J ~ p ~ p ~ m } ~ p ~ f ~ m ~ m ~ m > ~ m > ~ m > ~ ~ ~ ~ ~ ~ ~	015510	14	FTAX=Y5Y(J,K,Z)	FEGEN Etgen	16 17
> !«[*?[]#»#»M\$O[[]#»K}~4«[;*Q[]#M»K»M]*N[]MM»K\$+Q[]#—2;#»M] > *D[[#~2;K]][[]#»K]	01551b	15 15	£T14=YEY(J, 4, Z)	ETREN	1.
no 3 1≈3,1mm	DISCIP	17	SIGH=ARS(RET(J,K,2)+UxXXXVVVYYY)+TPXND+CQT(CTXXV+2+TJ+TV+T)	ET GEN	20
2. (1) **, ** = \${    J,    K,    N) = \$ #U + 0, 12;	DISSIP	15	/1084adab1()10852tub)	FTCEN ETGEN	21
> +0fJ=1,k3+6,G+0fJ,k,N3+0fJ,k3-4,C+3fJ+1,k,N3+0fJ+1,k3+0fJ+2,p,N3 > +0fJ+2,k31,nfJ,k3	015510	50	TFCSTGBRAGTASIGHAKI SIGMAKHSIGAR	FICEN	2.2
CSMOOTHING IN ETA DIRECTION	DISCIP	?1	TETTOTOEN. 1) 50 TO 7 VPTTT(4.1).1) J.W.SIGA.*IGE	ET GEN ET GEN	23
70 1 1=2,14	012210	2.2	1 CONTINUE	e & Cin	24 25
`(1,2,4)=\(1,2,4)=\MI+U.12\$+(-2,1=Q(1,2,4)+O(1,1,1+5,n+Q(1,2,4) > *(1,2)=4,0*Q(1,3,4)=(1,3)+2(1,4,4)+(1,4))+(1,2)	015510	23	OT+CH/ASS(STGMAX)	FFGEN	žé
	DISSIP	24 24	407_5007 .:: FORMAT(::::::::::::::::::::::::::::::::::::	ETGEN Etgen	,,
> (= 0 0 0 ( ) + K   M   0 0 ( ) + K   3 - 4 = 0 0 0 ( ) + K   M   M   0 0 ( ) + K   M   0 0 ( ) + K   M   2 + M   3   M   2 + M   3   M   M   0 0 ( ) + K   M   M   0 0 ( ) + K   M   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 ( ) + K   M   0 0 (	victio	?6	11 FORMATITHE, 37,243,47,24K,7X,445TGA,35,445TGR1	ETGEN	24
Jul 1 Kajakam	01551P	27 28	2 FORMATC//?? M DETERMINING STEPSITES AND TOMAY - 10E11.4.29.3UCM-	FEGEN	j.c
1	015519	36	• E9.2,3x,340T=,511,4//5	ELVEN	31
> *N[J,K-1]+6*[*0[J,K,N]*N[J,K]-4*(*)[J,K*;,N]*N[J,K*1]+Q[J,K*2,N]	DISSER	311	END	ETGEN	32 33
> 40(1,4+21)10(J,K)	n[<< [=	91 12		• • • • •	
‡Nn	01441=	33			
			***************************************		
			cuantarcum: vinex*anex*in*an*xnetn**fone*tene*cen*t*con*tt*chitbat*	INITIA COMI	,
			> CHOPO-CA+NOB+NOC+AA+H+OHEGA+NU+NL+TT+TAU+TTOP+FNT+PTORT+PTUR+	COMI	÷
COMMONICOME / SMAX, KMAY, JM, KM, XMACM, ALOMA, GAM, GAMEL, CH, CT, SMI, TOOT,	FFCTN	2	<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	CUMI	4
> CMMEP, NES, NES, AES, MAMPEGA, NULL NELTE, TAU, TELP, CNELDET, DENE	CJ≃l CJ≃l	,	LTMEL 3,4,4,44ET,423,4ET,0 COMMON /COM2/ X(4),21),4(4),21),4ET(41,21,27),4EX(4(,21,21,21)	Cúns Cúns	3
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	ch#:	2	* XFY(40,23,23.014,.2C)	COMP	4
[ V:	u0 ≈S	?	LEVEL 2.0,5 F, S, G, AB	57#3	?
"GMMTN  2CQM22" x (43,2C)	(7#?	3	COMMON /COM3/ Q(4),2,,41,EF(4.,41,5(4),20,41,C(4),AP(4,4) (EVCl 2, 4,4,6,40	ሮ ባ #4	3 2
LEVEL 2,005F,5,60AB	กวะวั	2	COMMON /COMA/ 4{4C,4,4},P!40,4,4},C{4),4,4},40{40,4,4}	COMA	,
CONTRACTOR OF THE PROPERTY OF	Comi	7	PY=3,161592654	INTTIA	7
Cosoff=21 AT A GIVIN NODE OF THE	EECJN	÷,	P&NT=57, 294 77 951 PTNE=1=0	ATTIPI	•
4.0(1)**}}	+==74	ė	O[NE=:a.	INTTIA	1:
91*1a:19 Ha0f3prp2)a91	SECON SECON		1997a. alomasjo(	INITIA Initia	11
V=0(],v-3)00T	25 CON	10	.[=?^L	INITTA	12
butanel at digarageme at attiella habit	FERTN	12	DNUCE of PE	THITTA	14
**************************************	FECTA	13	CHI=4 CINE=STO TIP TNF+SAM/OINE 3	INTTTA	15
1-4cA('1' k'1)	FFC3N	14	ALPHE ALPHA PAPT	TNITTA	10
CAPIV=XY+YY+U+Z+V	EECUN	14	Jine-Antine Cine	INTTIS	1 9
C(5)=U(1)+4°5)=CFbilA+AA+bUl C(5)=AeUFbilA	SECUM	17	AINE-JINENI INENT NET AINE-JINENI INENT NET NET NET NET NET NET NET NET NET	INTTIA	19
G(3)=O(U,F,3)=C&PUV+7+PN3	ECCIN		J==J*4Y=1	ATTTMI	2.
C(6)=9(J+*+6)+CAPUV+(CAPUV+XX)+PGJ	TECON	10	********	INTITA	22
TELINGED OF LE TON THE TON THE TELEVISION OF THE	FECUN	21	GAM1=GAM=1+; GAM11=1+6/GAMM1	INTTIA	23
**************************************	FECUN	22	7AU+0.4	INTTTA Inttia	24 25
_(174,071,04(1740,1740)	SECUN	74	17.	INSTIA	25
/{1}***31=_{{7***31**431**4**************************	EECUN EECUN	25 76	CLOCKE Y MOD Y MODAL POINTS OF MISM CALL MOLPES	INITTA INITES	77 20
<pre>&lt;( !, ", 4) = (( j, «, 4) + ( 0 ( j, «, 4) + 0 )</pre>	SECON	97	C+++C7MPHTF METPTCS	INTTI	7 <del>.</del> 20
DE TIIDA	<u> FEOGN</u>	2.0	CALL XTETAD(O)	INTTIA	36
. 411	FFC74	š d	CooolNITIALIYE O VECTOR IN FREE STREAM VALUER ON 1 4-1,KMAX	74]*TA [#]7]4	3?
			DO 1 telegamax	INITIA	32 33
			0[=1, 0/0(1, #)	INTITE	34
			0(j,k,2)=014F001 0(j,k,2)=014F001	THTTT4 IN IT IA	3.5 3.6
			?fJ,K,31=PINF+VtNE+DI	THETTA	37
COMMONITUE FEESW	ETGEN	?	111,K.41=(PINFOGAM) I+RINFOGNE+02+C.51+1	THITTA	3.0
"OMMON/COM? /IMAY,KMAY,JM,KM,KMACH,ALOHA,GAM,GAMHZ,CH,DT,CHIJ,TOOT, > CMORO,HCA,NCR,NCC,AA,H,OMEGA,HIJNL,IT,TAIJ,TFP,JENT,PTORT,PTNE,	00#1 00#1	?	CompSFT S ARPAY TO 1 EVERYWHERE DO 1 H-1,4	INTTIA	39 40
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	COMI	4	D.20(FeFeL) 7 1	THITIA	41
\ EV-f	C74?	ż	CossINTTIALTYE SLOW FIELD FOR ALUNT MONY PROALEM	THITTA	42
COMMON /COM2/ X{45,2C3,Y{46,2J3,YET(45,2C,23,YEX(43,2C,23), * YEY(44,23,23),O(45,2C3	CU#5	?	Carparameral Company of the company	THITTA INITIA	43
LEV ^e l 7.0.FF.S.G.AR	C 7 P 3	•	TF(495(YEX(3,1,2))-0.669)201) 5,6,7	INITIA	4.5
CONSTRUCT STEPSIFE GIVEN COURANT NUMBER  CONSTRUCT STEPSIFE GIVEN COURANT NUMBER	0043	•	6 THET - 90. FRADI	INSTEA	46
TF([PPT.GT.S] W0[T3(6.103)	FEGEN	4	7 THET-ATANE-XEY(J,1,2)/XEX(J,1,2))	THTTTA	4.7 4.8
214-44+U*G	ETGEN	ė	* CONTENUE	THITIA	49
nn 1 kalakhak nn 1 Jelahak	ETGEN		**************************************	INITIA	50
		10	AX=AWGCA+65+21M(2VAC)+65	THITTA THITTA	51 52
				• • • •	- •

,

PS={2.0+GAM+XX-GAMM1}/GAMP1+PINF	INTTIA	53
PS=GAHP1+XX/EGAHM1+XX+Z+D3+BENF	INITIA	54
US={1.Q+2.Q+{xx-1.D3/G4MP1/xM4CH++Z1+Q1MF	INITIA	55
VS=2.0*(XX-1.0)*CDS(SANG)/(GAPPI*XNACH**2*SIN(SANG))*OINF	INITIA	56
1F(1.6T.2) 60 TD 3	INTITA	57
Y1=(2-4+GAH+XHACH++2-GAHH13/(GAH+1.0)	INITTA	58
x2=(GAM+1.0)+xmach++2/(GAMM1+xmach++2+2.0)	INITIA	59
P1=X1+PIHF	ATTINI	6 Č
91 = X2 + 9 1 M F	INTTIA	61
ENT-P1/P1++GAM	INITIA	5 2
PT-[].0/X]) +-(1.0/GAHH])+(0.5+(GAH+].)+YMACH++2)++(GAH/GAMH])+PINF		63
XX=1.0+3.5*GAMM1*XMACH**2	INTTIA	64
PTORT-XX-PTNF/RINF	INITTA	65
3 CONTINUE	INITIA	66
PB-PINF+((PT/PINF-1.0)+(1.0-1.02+SIN(THET)++Z+0.1Z+SIN(THET)++4)+	ATTEM	67
> 1.01	INITIA	6.0
RR-(PR/ENT) **(1.0/GAM)	THITTA	69
OR=SORT(2.3+GAM/GAMM1+ARS(PTDRT-PB/RR))	THITTA	70
YY-PI-0.5-THET	ATTIFE	71
VR=QR=CN(YY) VR=QR=SIN(YY)	INITIA Inttia	72 73
7KM=KMAX-1 10 2 K=1,KMAX	INITTA Initia	74 75
YY-FLOAT(K-1)/ZKM	INTTEA	
bbE22~ba+AA+(b2~bd)	THITTA	76 77
RHU=88+AA+( K2-K8)	THITTA	78
i)AET=i\u00e44\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00e4\u00	INITIA	79
AAEF=24+AA+ (A2-A8)		
71-1.d/P(J, K)	INITIA Initia	91
O(J,K,1)=R40+D[	INITIA	87
O(J,K,2)=R4O+UYEL+DI	THITIA	43
0(1)*k'31=840+AAET+DI	ATTIFE	94
2 O(J,K,4)=(PRESS+GAM1I+RHO+(UVEL++2+VVEL++2)+0.5)+D[	THITTE	45
C REFLECT METRICS AND DEPENDENT VARIABLES ABOUT PLANE OF SYMMETRY	INITIA	96
DE 4 KelaKMAN	THITTA	67
7D=(-1.0)**JC\$	INTITA	5.0
UD=(+1*D)++1C2	INITIA	89
0(1,K)=0(7,K)+0D	INTITA	93
4Ex(1'k'1) - xEx(5'k'1)	INITIA	91
YEY(1,K,1)*XEY(2,K,1)	ENTTEA	95
YEX(1,K,2)*XEX(2,K,2)	INITEA	93
xEY(1,x,2)=-xEY(2,K,2)	INTTE	94
00 5 N+1,4	INITEA	95
5 0(1,4,4)=0(2,K,H)+DD	INITTA	96
, 4.19-1-4-1-5KPR1-1-00		
4 0(1,K,3)=-0(7,K,3)+00		97
4 0(1,K,3)=-0(2,K,3)+00 PETUP4	INSTEA	97 98
4 0(1,x,3)=-9(2,k,3)+00 PETUP4 PND		97
PETUPN	INTTIA Entyta	97 98
PETUPY PND	THITTA THITTA THITTA THITTEGR	97 98 99
PETUPY PND	THITTS INTITS INTITS INTEGR	97 98 99 2 2
PETUPM  CUMMONITIME INTECR COMMONITORI JIMAKKA, JMAKHA, XMACHA, ALPHA, GAMMAGAMMI, CNA DTA SHIIA, FRETA COMMONITORI JIMAKKAXA, JMAKHA, XMACHA, ALPHA, GAMMAGAMMI, CNA DTA SHIIA, FRETA COMMONITORI NO NOCA ALMANDEGA MILANIA TA TANIA TERA SHITA PENERA	THITEGRE	97 98 99
PETUPM  CUMMONITIME INTECR COMMONITORI JIMAKKA, JMAKHA, XMACHA, ALPHA, GAMMAGAMMI, CNA DTA SHIIA, FRETA COMMONITORI JIMAKKAXA, JMAKHA, XMACHA, ALPHA, GAMMAGAMMI, CNA DTA SHIIA, FRETA COMMONITORI NO NOCA ALMANDEGA MILANIA TA TANIA TERA SHITA PENERA	THITTA THITTA THITTA THITEGR COMI COMI	97 98 99 2 2 2
PETUPY FND  CURROUTIME INTEER COMMONICOMI JIMAYKHAX, JIP,KH, XMACU, ALZMA, GA4+GA4*MI, CM+OT+SMU, FPRT+ > CHOROSHICOM NOSNICOS ARYBORECA, MU, MI, FT, TA115 TFR, FMT, PTIRT, PTIMF- CFINE, OTMF, CEMF, JES, TP, CLUS, PT, HURN, RMOSE, MCASE, MPUMCH L FVEL 2-O-LEF, JEG, AB	INITIA INITIA INITIA INITEGR COMI COMI COMI	97 98 99
PETUPM FND  **Unarnitime inter channy/comi.jarykhax, jh, kh, xhacu, alpha, cam, camil, ch, ot, smu, tprt, > choro, rca, rca, rcc, ar, w. onera, ul, ml, tt, tails tte, eth, eth, ethe, ethe, other, ite, jcs, th, cus, eth, eth, eth, eth, eth, eth, eth, cus, eth, eth, eth, eth, eth, eth, eth, eth	INITIA INITIA INITIA INITEGR COMI COMI COMI COMI COMI	07 98 99
PETUPY FND  CURROLITIME INTEER COMMONITOMI JIMAYKHAX, JIM,KH, XMACU, ALPHA, GA4, GA4MI, CN, OT , SMIL, TPRT > CHORONICO, MCB, NCC, AA, 4, OMECA, NU, NL, TT, TAID, TTRO, ENT, PTINT, PTINF, CTINE, OTHE, CTUF, JCS, TM, CTUS, PT, HORN, BMOSE, VCASE, MUNICUL L VCE 2, OLEF, JG, AB COMMON /COMAJ CICA, 25, 64), EF(4), 61 COLONDIUTE FORCING FUNCTION AND STORE TEMPORATITY TN S ABRAY	INTEGRECOMI COMI COMI COMI COMI COMI COMI COMI	97 98 99 2 2 3 5
PETUPY FND  **UPROUTING INTEGR COMMON/COMI,/JART/KMAX,JM,KM,XMACM,ALPMA,CAM,GAMMI,CN,OT,SMU,TPRT, > CHORO,MCA,MCS,MCC,AA,MOMECA,MU,MI,TT,TAM,TTER,EMT,FTORT,FTMG,  (FINE,SIME,CIAF,JCS,TPC,CUS,FTFMORN,BMTSE,MCAST,MUMCH  LEVEL 2,0.EF,SS.GAB COMMON /COMITY GABAZCAGAT,EF(4),41,5(4%,22,4),7(41,48(4,4))  Composite Forethic Function and Store Tempoparity in S abray CALL MAS	INTEGRECOMI COMI COMI COMI COMI COMI COMI COMI	07 98 99 2 2 2 3 5 6
PETUPY FND  **CURROLITIME INTEGR COMMONATION JURAPAKHAX, JM, KM, XMACU, ALDMA, GRAW, GRAWL, CN, OT & SMU, TPRT, > CHORO, MCA, MCB, MCC, AA, M, OMECA, NU, NL, TT, TA'IS TTRO, ENT, PTINT, PTINT, PTINT,  «FINE, STWE, CIME, SEC, XB, M, OMECA, NU, NL, TT, TA'IS TTRO, ENT, PTINT,  EVEL 2, OLEF, SEG, AB COMMON /COMAJ CICA, 22, 43, C(4), 2, 43, C(4), 41  Co. COMMON /COMAJ CICA, 22, 43, C(4), 2, 43, C(4), 47  CALL RMS CALL RMS CO. ADD FOURTH OPDER DISSIPATION TO SMOOTH SOLUTION	INTITA INTITA INTEGR CONI CONI CONS INTEGR INTEGR	07 99 22 24 23 56 7
PETUPY FND  ***CHMMN/COM1/JMAY,KMAX,JM,KM,XMACM,ALPMA,GAMMI,CM,OT,SMIJ,TPRT,	INTITA INTITA INTITA INTEGR COMI COMI COMI COMI INTEGR INTEGR INTEGR	07 99 22 3 5 6 7
PETUPY FND  CUMPONITIME INTEGR COMMONATIONAL JIMAKKAX, JIMAKH, XMACU, ALDMA, GRAW, GRAWNI, CN., OT & SPIL, TPRT. > CHORD, MCD. MCS., MCC.; ARAN, OMECA; NU., NI., IT, TAND. TTRE, ENT., PTINE, COTINE, OTHE, CIME, JCS., TPRCLUSS, PT., HORN, RANSE, MCR. SE, MOUNCH LEVEL 2, OLEF, 256, AS COMMONATIONAL CONTROL OF	INTITA INTITA INTITA INTEGR COMI COMI COMI COMI INTEGR INTEGR INTEGR INTEGR INTEGR	07 99 22 3 5 6 7 8
PETUPY FND  ***COMMONITIME INTEGR COMMONITIME INTEGR COMMONITIME INTEGR COMMONITIME INTEGR COMMONITIME INTEGR COMMONITIME INTEGRATION TO SHORTH SOLUTION COLOR, SECRETARY COLOR FOR THE COLOR FOR THE CASE, WHICH LEVEL 2,0,6EF,556,8B COMMON 10037 (40),2594),EF(40),41,5(40,27,4),F(41,4F(4,4) COLOR FORETHE FUNCTION AND STORE TEMPOPARTLY TH S APRAY CALL WAS COLOR FOR THE STRATION TO SHORTH SOLUTION CALL SISSIP COLORS FOR THE CABRAGARA	INTITA INTITA INTITA INTEGR COMI COMI COMI INTEGR INTEGR INTEGR INTEGR	07 98 99 22 24 23 56 7 8
PETUPY FND  CUMPONITIME INTEGR COMMONATIONS JURKER, KMAX, JM, KM, XMACH, ALDMA, GRAM-GRAMMI, CN, DT. SPHI, TPRT. > CHORD, MCDA, NCB, NCC, AAPM, DMECA, NU, NL, TT, TAND, TTRE, ENT, PTORT, PINE, COTNE, DIME, CIME, JCS, TM, CLUS, PT, HORN, RMYSE, MCRIE, MUNCH LEVEL 2, OLEF, SAG, AB COLORMON / COMAJ CICA, 200, AL, SCC4, 200, AL, CC61, APCA, AI COLORMON FORMER FUNCTION AND STORE TEMPOPARTITY TN S APRAY CALL ANS COLORDON FORMER CHARTON TO SMOOTH SOLUTION CALL STORE COLORDON FOR PROBABLISH COLORDON FOR PROBABLIS	INTITA INTITA INTITA INTEGR COMI COMI COMI COMI INTEGR INTEGR INTEGR INTEGR INTEGR INTEGR	27 99 22 23 4 23 5 6 7 9 10
PETUPY  END  ***CHARCHITIME INTEGR COMMONICOMININARY, JM, KM, XMACH, ALPMA, GAMMI, CM, DT, SPHI, IPRT, > CHORD, MCA, MCB, MCC, AA, M, OMECA, MU, ML, IT, TAN, ITFR, SMT, PTRT, PTRT,  **PTM-, CTMF, CTMF, JCS, TM, CTUS, PT, HORN, RMOSE, MCASE, MPUNCH LEVEL 2, O, EF, S, GAB C, CM, CM, CM, CM, CM, CM, CM, CM, CM, C	INTIIA INTIIA INTIIA INTEGR CONI CONI CONI INTEGR INTEGR INTEGR INTEGR INTEGR INTEGR	2 2 2 3 4 2 3 5 6 7 8
PETUPN FND  CURROLITIME INTEER COMMONATIONS JIMASKHAX, JIM, KH, XMACH, ALPHA, GAM-GAMMI, CN., DT., SMIL, TPRT. > CHORO, NGA, NGA, NGC, AA, M, DRECA, NU, ML, TT, TAIL, TTRA, ENT., PTORT, PIME, COTNE, JUMF, CIME, JES, TM, CLUSS, PT, HORM, BMOSE, MCASE, MUNMON LEVEL 2, OLEF, SG, AB COMMON FORMAT GAD. 25, 64), EF(4), 4), 5(40, 22, 4), C(4), AP(4, 4) CALL MAS CALL MAS CALL MAS CALL STSIP  CO., ADD FOURTH OPDER DISSIPATION TO SHOOTH SOLUTION CALL JUSSIP  CO., THE LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., FILL LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., THE LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., THE LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., THE LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., THE LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., THE LETEMYS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH	THITIA INITIA	2 2 2 2 3 4 2 1 5 6 7 7 9 10 11 12 12
PETUPN  CUMPONITIME INTEGE  COURT OF THE POLICY OF	INITIA INITIA INITIA INITIA INITIA INITIA INITIA INITIA INITIGO INITIA INITIA INITIA INITIA INITIA INITIA INITIA INITIA INITIA	2 2 2 3 5 6 7 7 9 9 100 111 122 134
PETUPN FND  ***CUMMANUTCHE INTEGER COMMANUTCHE, JURASHARAY, JUP, KM, YMACU, ALDHA, GAM-GAMMI, CN.OT.SPMI, TPRT. > CHORO, NGA, NGA, NGC, AA, M, OMEGA, NU, NI, TT, TAID, TTRA, ENT, PTINT, PTINT, PTINT, - CHORO, NGA, NGA, NGC, AA, M, OMEGA, NU, NI, TT, TAID, TTRA, ENT, PTINT, - CHORO, NGA, NGA, NGA, NGC, AB, M, SIGN, SIGN, SIGN, ADVICAL LEVEL 2,00.EF, 25.GA, AB  C.O.COMMINT FOURTH OPDER DISSIPATION TO SHOOTH SOLUTION CALL ANS CO.ADD FOURTH OPDER DISSIPATION TO SHOOTH SOLUTION CALL SISTE  C.O.STUYE FOR ORBARARA  OI 1 K-2, KM CO.STUL ELEMENTS OF IOMPOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO.STULE LEMENTS OF IOMPOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO.STULE LEMENTS OF IOMPOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO.STULE LEMENTS OF IOMPOX A FOR BLOCK TRIDIAGONAL TOWERS ON AT EACH CO.STULE LEMENTS OF IOMPOX A FOR BLOCK TRIDIAGONAL TOWERS ON AT EACH CO.STULE PROCK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN CO.STUNEST RIDICK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN CO.STUMEST RIDICK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN CO.STUMEST RIDICK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN CO.STUMEST RIDICK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN CO.STUMEST RIDICK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN CO.STUMEST RIDICK TRIDIAGONAL HATRIX AT K TH LEVEL AND STOPE TOURTION IN	INITIA IN	07 97 99 2 2 2 4 2 7 7 9 9 10 11 12 13 14
PETUPN  CUMEDITINE INTEGE  COMMONICOMIJINATERNAX, JM, KM, XMACH, ALPMA, GAMMGAMMI, CN, DT. SPHIPTERT,  CHORP, NCA, NCB, NCC, AAG-MOMECA, NU, NI, JTT, TAM, JTTR, ENT, PTORT, PTORT,  CETUP, JUMF, CIMF, JCS, TM, CIUS, PT, HURN, RMOSE, NCASE, MPUNCH  LEVEL Z, OLER, S, G, AB  COMMONIC ERROR FUNCTION AND STORE TERPOPARTLY IN S ARRAY  CALL HAS  C. ALADA FOURTH OPDER DISSIPATION TO SHOOTH SOLUTION  CALL JISSIP  CASILVE FOR O-BAR-HAR  OO I M-2, KM  COASTUL ELEMENTS OF IGHOOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  COASTUL ELEMENTS OF IGHOOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  COASTULE LEMENTS OF IGHOOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  COASTULE TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  COASTULEST TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE SOLUTION IN  CALL TRIPITZA, JM)	INITIA IN	2 2 3 6 7 7 7 8 9 10 11 12 13 14 15 16
PETUPN  CUMPONITIME INTEGE  COMMONATORIL/JURAPAKHAX, JM, KM, XMACU, ALJMA, GAM-GAMMI, CN. OT SPMI, TPGT.  COMMONATORIL/JURAPAKHAX, JM, KM, XMACU, ALJMA, GAM-GAMMI, CN. OT SPMI, TPGT.  COMPON HOS NOS, NOCO AAA M. OMECA, NU, NI, TT, TANDITER, NOT OTTORT, PINF.  COTO, DIMPON TOMAN TOMAN CONTROL TO STANDAM TO STANDAM TOMAN TOM	INITIA IN	07 97 99 2 2 3 4 2 7 7 7 9 10 11 12 13 14 15 16 17
PETUPY  END  ***CUMMONITIME INTEGR COMMONITORS JANAKHAY, JMAKHAY MACHAALPHAAGAMMI, CNADTAS PHIATORT, > CHORDANCIA MCSANCO, AASHADMECAA MU, MLATTATAIIATTERAKHATAPHATAPHERT, PINFA, DIWFACIMFA, JCS, TRACUIS, PT, HORNARMASE, NCASE, NPUNCH LEVEL 2, OAEFA, SAAB CAACHMONITE FORCING FUNCTION AND STORE TERPOPARTIY IN S APRAY CALL MAS  CAACHMONITE FORCING FUNCTION AND STORE TERPOPARTIY IN S APRAY CAALD SISTEM CAACH OLSSIP CASTUVE FOR DARABAR OI 1 ***2,****  CAACH LEVEL CALL LETPACK)  CAACHMONE TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE TRODIAGONAL TRODIAGO	TNITIA INITIA IN	2 2 2 3 5 6 7 8 9 10 11 12 13 14 15 17 18
PETUPY  END  ***CUMMONITIME INTEGR COMMONITORS JANAKHAY, JMAKHAY MACHAALPHAAGAMMI, CNADTAS PHIATORT, > CHORDANCIA MCSANCO, AASHADMECAA MU, MLATTATAIIATTERAKHATAPHATAPHERT, PINFA, DIWFACIMFA, JCS, TRACUIS, PT, HORNARMASE, NCASE, NPUNCH LEVEL 2, OAEFA, SAAB CAACHMONITE FORCING FUNCTION AND STORE TERPOPARTIY IN S APRAY CALL MAS  CAACHMONITE FORCING FUNCTION AND STORE TERPOPARTIY IN S APRAY CAALD SISTEM CAACH OLSSIP CASTUVE FOR DARABAR OI 1 ***2,****  CAACH LEVEL CALL LETPACK)  CAACHMONE TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CAACHMONET TRODIAGONAL MATRIX AT K TH LEVEL AND STORE TRODIAGONAL TRODIAGO	INITIA IN	07 97 99 2 2 3 4 2 7 5 6 7 7 7 9 10 11 12 13 14 15 16 17 18
PETUPY FND  **UPRONITIME INTEER COMMONATOMIC/JUAZEKHAX, JM, KM, ZMACH, ALPMA, GAM-GAMMI, CN, DT, SMN, TPRT, > CHORONACO, MCS, NCC, AAS-N-OMECA, NU, NI, JT, TAN, JTFR, ENT, PTIRT, PINF,  **FINE, OINF, CIMF, JCS, TM, CIUS, PT, HORN, RMOSE, MCASE, MPUNCH LEVEL Z, OLEF, SAG, AB COMMON FORETH GEORE THE STORE THE POPARTLY THIS ARRAY CALL MAN FORETH GEORE DISSIPATION TO SHORTH SOLUTION CALL DISSIP CALD FORETH GEORE DISSIPATION TO SHORTH SOLUTION CONSTILVE FUT G-BAR-BAR OI 1 **22,KM CFILL ELEMENTS OF IN-MOX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CONSTILVE LEVEL CALL LELEFACK; CINVEYT NICK TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTILVE TRIDIAGONAL MATRIX AT KITH LEVEL AND STOPE SOLUTION IN CONSTITUTE OF SARE	TNITIA INITIA	2 2 2 3 5 6 7 8 9 10 11 12 13 14 15 17 17 17 17 17 17 17 17 17 17 17 17 17
PETUPY FND  CUMPOSITIME INTEGE COMMONATOMICINAL SKHAX, JH, KH, YHACH, ALPHA, GAM-GAMMI, CN., DT. SMIL, TPGT. > CHORON, HOLD, NO. SHOCC, AA, M, OMECA, NU, MI, JT, TASIS TERP, ENT. PTORT, PIME, COTME, DIME, CIME, JCS, TP, CLUS, PT, HORM, RMYSE, MCASE, MUNMON LEVEL 2, O. EF, S. G. AB COLONNING FOR GENETION AND STORE TEMPOPARTY THE SAPRAY CALL RMS CO., ADD FOURTH OFDER DISSIPATION TO SHOOTH SOLUTION CALL SISSIP CO., STORE FOR OMBRENAR OI 1 * 2 pKM CO., FILE LESEMIS OF I HOMON A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., TH LEVEL CALL LEITEMIS OF I HOMON A FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO., TH LEVEL CALL THE LESEMIS OF I HOMON A FOR BLOCK TRIDIAGONAL TOWERS ON AT EACH CO., STORE THE COCK TRIDIAGONAL NATRIX AT K THE VEL AND STORE SOLUTION IN CO.S ARRAY CALL METRICAJH) OI 1 = 12-14 1 CIJKKI 1= EF GJ. B CO., STORE SOLO GORRE CO. STORE SOLO CO.	INITIA	07 99 99 2 2 3 4 2 7 5 6 7 7 9 9 10 11 12 13 14 15 16 17 18 18 19 19 19 19 19 19 19 19 19 19 19 19 19
PETUPN  CUMPATITIME INTEGE  COMMANDATIONS JIMASPAKHAX, JM, KM, XMACU, ALPHA, GAM-GAMMI, CN, DT. SMID, TPRT  > CHORONACIA NOS NOCO, AAA-W, DRECA, NU, MI, TT, TA'ID, TTRO, ENTO, PTORT, PIME,  COTNE, DIME, CIME, JCS, TM, CLUS, PT, HORM, RMYSE, MCASE, MUUMCH  LEVEL 2, O.E.F., S.G., AB  COMMON FORMAT GENCTION AND STORE TEMPOPARTY TN S ARRAY  CALL MAS  CO., ADD FOURTH ORDER DISSIPATION TO SMOOTH SOLUTION  CALL SUSSIP  CO., STORE FOR ORDER ARE ARE  CO., THE LETEMENS OF I-4-DX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  CO., THE LETEMENS OF I-4-DX A FOR BLOCK TRIDIAGONAL THOUSES SOLUTION IN  CO., STOREY  CALL MATERIAL AND STORE SOLUTION IN  CO., STOREY  CO	THITIA INITIA IN	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
PETUPN  CUMPRINTIME INTEGE  COMMONATIONS JINASHAKHAX, JIM, KH, XMACU, ALPHA, GAM-GAMMI, CN., DT. SMIL, TPGT.  > CHORONACIA NOS. NCC. AAA-W. DRECA, NU. MI, TT, TAID, TTRO, ENT., PTNET,  - FINE, JUMF, CIMF, JCS, TM, CLUSS, PT, HORM, RMYSE, MCASE, MUUMCY  LEVEL Z, O. EF, S. G. AB  COMMON FORMAT GENERATION TO SHORTH SOLUTION  CALL MAS  C. ALL MAS  C. ALL MAS  C. ALL TO FOURTH OFDER DISSIPATION TO SHORTH SOLUTION  C. ALL SUSSIP  C. STILVE FIPD ORBAR-MAR  C. S. FILL ELEMENTS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  C. S. TH LEVEL  C. ALL LELTMACK)  C. S. ARRAY  CALL MATERIAL  C. S. ARRAY  CALL MATERIAL  C. S. ARRAY  C. S. JAME  C. JAJAKI LEEFS JAD  C. S. JAJAKI LEEFS JAD  C. S. JAJAKI LEEFS JAD  C. S. SILVE FOR ORBAR  C. S.	INITIA	2 2 3 4 2 7 5 6 7 7 8 9 9 10 11 12 11 11 11 11 11 11 11 11 11 11 11
PETUPN  CUMPRINTIME INTEGE  COMMONATIONS JINASHAKHAX, JIM, KH, XMACU, ALPHA, GAM-GAMMI, CN., DT. SMIL, TPGT.  > CHORONACIA NOS. NCC. AAA-W. DRECA, NU. MI, TT, TAID, TTRO, ENT., PTNET,  - FINE, JUMF, CIMF, JCS, TM, CLUSS, PT, HORM, RMYSE, MCASE, MUUMCY  LEVEL Z, O. EF, S. G. AB  COMMON FORMAT GENERATION TO SHORTH SOLUTION  CALL MAS  C. ALL MAS  C. ALL MAS  C. ALL TO FOURTH OFDER DISSIPATION TO SHORTH SOLUTION  C. ALL SUSSIP  C. STILVE FIPD ORBAR-MAR  C. S. FILL ELEMENTS OF JOHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  C. S. TH LEVEL  C. ALL LELTMACK)  C. S. ARRAY  CALL MATERIAL  C. S. ARRAY  CALL MATERIAL  C. S. ARRAY  C. S. JAME  C. JAJAKI LEEFS JAD  C. S. JAJAKI LEEFS JAD  C. S. JAJAKI LEEFS JAD  C. S. SILVE FOR ORBAR  C. S.	TNITIA INITIA IN	2 2 2 2 2 2 3 5 6 7 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
TUPACHITIME INTEGR  COMMONATIONAL JURASPAKHAX, JM, KM, XMACH, ALDMA, GRAM-GRAMMI, CN. OT SPMI, TPGT.  > CHORD, NGCA, NGCA, NGCA, ARAM, OMEGA, NU, NI, TT, TAMISTYER, ENT. PTORT, PINE,  OTNE, DIME, CIME, JCS, TM, CLUS, PT, HORM, RAMSE, CASE, MOUNCH  LEVEL 2, OLER, JGGA, BA  CO. COMMONATORIA FUNCTION AND STORE TEMPOPARTITY THIS ARRAY  CALL RUS  CO. ADD FOURTH OFDER DISSIPATION TO SMOOTH SOLUTION  CALL SISTE  CO. STOLY FOR OMBRE AREA  O I M-22 KM  CO. FILL ELEMENTS OF INHODX A FOR BLOCK TRIDIAGONAL INVERSION AT EACH  CO. TH LEVEL  CALL THIS CONTROL TRIDIAGONAL HATRIX AT K TH LEVEL AND STORE TOLITION IN  CO. SARAY  OLITICALL STEPS  OLITICALL SISTE  CO. SARAY  OLITICALL SISTE  CO. SARAY  OLITICALL SISTE  CO. SARAY  OLITICALL SISTE  CO. SARAY  OLITICALL SISTE SIJE  CO. SARAY  CO. SARAY  CO. SARAY  OLITICALL SISTE SIJE  CO. SARAY  CO. SARAY  OLITICALL SISTE SIJE  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY  CO. SARAY  CO. SARAY  OLITICAL SISTE SIJE  CO. SARAY	INITIA	2 2 3 4 2 3 5 6 7 8 9 9 10 11 12 13 11 15 11 12 22 22 22 22 22 22 22 22 22 22 22
PETUPY FND  **CURROUTIME INTEGR COMMONATIONS JUNAKHANACU, ALPMA, GRAM-GRAMMI, CM. DT. SMUJEPTT. > CHORD-NICAS MCS. NCC. ARAM-OMECA, MU. ML. TT. TANDITER, ENT. PTORT, PIMF.  **CINE, DIMF, CIMF, JCS., TR. CLUSS PT. HORN, BMNSE. MCRSE, MEDIMCY LEVEL 2, OLEF, SAG, AB  CO. COMMONATION FOR DISSIPATION TO SHORTH SOLUTION CALL MUS  CALL MUS  CALL MUS  CALL MUS  CO. SOLUTE FOR OMERA—RAR  ON I MEZAKM CO. FILL ELEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. CALL MUS  CALL MUS  CALL ATTICZ, JM ON I MEZAKM CO. SAUREY  CALL ATTICZ, JM ON I MEZAKM CO. SAUREY CALL TRIDIAGONAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN CO. SAURAY  CALL ATTICZ, JM ON I MEZAKM CO. FILL ELEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. CALL MUSE THE COMPARE ON 2 JAZ-JM CO. FILL ELEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL INVERSION AT EACH CO. THE LEMENTS OF IMMONA FOR BLOCK TRIDIAGONAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN CO. THE PROPERTY OF TH	TNITIA INITIA IN	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
PETUPN  CUMPANITIME INTEGE  COMMAND/COMIJ/JRADAKHAX, JM, KM, XMACU, ALDMA, CAM-GAMMI, CN.OT. SMU, TPT.  CHORO, MCGA, MCGA, MCC, AAAM, OMECA, MU, MI, TT, TAMITTER, EMT, PTINT, PINF,  COTINE, OTME, CIME, JCS, TP, CCUIS, PT, HORM, BMYSE, MCASE, MUUMCH  LEVEL 2, OLEF, JSG, AB  CO. COMMON / COMAJ OGAD, 25, 64), EFF40, 41), SC40, 27, 41, FC41, APC4, 41  CO. COMMON / COMAJ OGAD, 25, 64), EFF40, 41, SC40, 27, 41, FC41, APC4, 41  CO. COMMON / COMAJ OGAD, 25, 64, 64, 64, 27, 41, 64, 41  CO. ALD ROUNTE FUNCTION AND STORE TEMPORATION TO SARRY  CALL USISTP  CO. STUDY FOR OMBREAHAR  ON I MEZ, KM  CO. FILL ELEMENTS OF IOMODY A FOR BLOCK TRIDIAGOMAL INVERSION AT EACH  CO. TH LEVEL  CALL CATPACK;  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. J J2-2JM  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. J J2-2JM  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. J J2-2JM  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. ARPAY  CALL BTRILD,  CO. ARPAY  CALL BTRILD,  CO. CALL BTRILD,	INITIA	2 2 3 4 2 3 5 6 7 8 9 9 10 11 12 13 11 15 11 12 22 22 22 22 22 22 22 22 22 22 22
PETUPN  CUMPONITIME INTEGE  COMMONATOMICINALIZARIAX, JA, KH, XHACH, ALPHA, GAM-GAMMI, CM, DT, SMIL, TPT.  CHOPONICAS MOSNICO, AAN-NOMECA, MU, MI, TT, TA'I, TTRO, ENT., PTORT, PIMF,  CHECL 2, OLEF, SAG, AB  COMMONATOMIC SUCCESSOR STANDAND STORE TEMPOPARTLY THIS ARRAY  CALL MAS   INITIA IN	07 99 22 3 4 23 5 6 7 7 9 9 11 112 113 113 114 117 117 117 117 117 117 117 117 117	
PETUPN  CUMPANITIME INTEGE  COMMAND/COMIJ/JRADAKHAX, JM, KM, XMACU, ALDMA, CAM-GAMMI, CN.OT. SMU, TPT.  CHORO, MCGA, MCGA, MCC, AAAM, OMECA, MU, MI, TT, TAMITTER, EMT, PTINT, PINF,  COTINE, OTME, CIME, JCS, TP, CCUIS, PT, HORM, BMYSE, MCASE, MUUMCH  LEVEL 2, OLEF, JSG, AB  CO. COMMON / COMAJ OGAD, 25, 64), EFF40, 41), SC40, 27, 41, FC41, APC4, 41  CO. COMMON / COMAJ OGAD, 25, 64), EFF40, 41, SC40, 27, 41, FC41, APC4, 41  CO. COMMON / COMAJ OGAD, 25, 64, 64, 64, 27, 41, 64, 41  CO. ALD ROUNTE FUNCTION AND STORE TEMPORATION TO SARRY  CALL USISTP  CO. STUDY FOR OMBREAHAR  ON I MEZ, KM  CO. FILL ELEMENTS OF IOMODY A FOR BLOCK TRIDIAGOMAL INVERSION AT EACH  CO. TH LEVEL  CALL CATPACK;  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT K TH LEVEL AND STORE SOLUTION IN  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. J J2-2JM  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. J J2-2JM  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. J J2-2JM  CO. STANGET ROCK TRIDIAGOMAL MATRIX AT J TH LEVEL AND STORE SOLUTION IN  CO. ARPAY  CALL BTRILD,  CO. ARPAY  CALL BTRILD,  CO. CALL BTRILD,	INITIA	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

TAU=TAU+DT RETURM FMO	IMTEGR IMTEGR IMTEGR	31 32 33
SUBROUTINE LBLTRACKS	LBLTRA	2
COMMON/COMI/JMAX,KMAX,JM,KM,XMACH,ALPHA,GAP,GAMMI,CN,DT,SMU,IPRT, > CHORD, HCA,HCB,HCC,AA,M,DMEGA,HU,HL,IT,TAU,TTER,EMT,PTORT,PIHF, <pihf,oinf,cimf,jcs,tm,clus,pt,horm,rmose,mcasf,mpunch 2,q,ef,s,g,ab<="" level="" td=""><td>COM1 COM1 COM1</td><td>? 3 4</td></pihf,oinf,cimf,jcs,tm,clus,pt,horm,rmose,mcasf,mpunch>	COM1 COM1 COM1	? 3 4
COMMON /COM3/ Q(40,26,4),EF(45,4),S(4;,20,4),G(4),AM(4,4) LEVEL 7, 4,7,C,MD	CO #3 CO #4	3 2
COMMON /COM4/ 4849.4,41,9840,4,41,C640,4,41,40840,4,41 DD 1 J=1,JMAX	COM4 LBETRA	3
CossLTAD SLIGER & MATRIX EVALUATED AT N TH LEVEL FOR ALL J INTO HD ARRAY CALL ARMATX(JyKyl) OD 1 Halp4	LBLTRA LBLTRA LBLTRA	7 8
NN 1 L=194 1 HD(J,L,M)=49(L,M)	LOLTRA	10 11
CFILL OFF-DIAGONAL AND DIAGONAL ELEMENTS BASED ON A 2-MD DRDFR CCENTRAL DIFFERENCE	LBLTRA	12
70 2 J=2,3J4 70 2 H=1,4	LBLTRA	14
NO 3 Lelp4 A[J>[sM]==HO(J=1>[sM]=H	LALTPA LBLTRA	16 17
*(J,L,**)*0.0 3 ((J,L,**)*49(J+1,L,*)*)*4	LBLTRA LBLTRA	10
Coo.FILL FORCING FUNCTION FROM S ARRAY  CF(J,M)=S(J,K,M)	LBLTRA LBLTRA	2 C 2 1
CSET A NY THE DIAGONAL REPRESENTING THE IDENTITY MATPLY TO ONE 2 RIJ.P., 41 -1.0 RETURN	LGLTRA LGLTRA	22 23
EMD EMID	LBLTRA LBLTRA	24 25
SIMPOUTINE LALTER(1)  romany(OM, JAMAXKMAXJM, KM, XMACM, ALPMA, GAM-GAMMI, CM, DT, SMU, TPET,  romany(OM, JAMAXKMAXJM, KM, XMACM, ALPMA, GAM-GAMMI, CM, DT, SMU, TPET,  corm, OME, CLMA, JCS, TM, CLUS, PT, MORN, MMOSE, MCATE, NOUNCH  LEVEL 2-0-EF, S. GAB  romann / COMBON (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140) (140)	LSITER COMI COMI COMI COMS COMS COMS COMS COMS LSITER LSIT	22342323678901123456789012245
SUBROUTINE LUDECIAI DIMENSION A(4-4) REAL LIJALZIA, LZZALZIA, LZZALZIA, L42, L43, L44 COMMON Y(LUD I LIJALZIA, LZZALZIA, LZZALZIA, L42, L43, L44, Y1, YZAYZAYA,  UZAUZZAULA, UZA, UZA, UZA, UZA SURROUTINE COMPUTES L—U DECOMPOSITION ZLEMENTS	LUDEC LUDEC LUDEC LUDEC	2 3 2 3 6 5

912 = ¥104(1,2) U13 = ¥104(1,3)	LUNEC				
U14 = V104(1.4)	FADEC	ě	X(J,K)=XB+ZK+DX	HOLPTS	56
LZI - A(2,1)	LUGEC	10	Y(J, v)=Ynozkody 4). Contembe	NOLPTS	57
122 • A(2.2) - 121aura	LUDEC	11	NO 50 K-1, KNAX	HOLPTS	50
V2 + 1./(22	LUDEC	12 13	X(1,K)=X(2,K)	MOLPTS	59
"23 = 1 A(2,31 -L210U13)0 V2 "26 = 1 A(2,41 - L210U13)0 V2	LUDEC	iš	Y(1,K)=-Y(2,K)	MOLPTS ROLPTS	66 61
131 • 4(3,1)	LUDEC	15	5) COMTINUE PRIVON	HOLPTS	62
L32 = A(3,2) = L31em2	FRISE	16	ENT	HOLPTS	63
133 - 4(3:31 - 121:H12 - 12:4H22	FRUEC	17		MOLPTS	64
~3 - 10/L33	LUDEC	10			
036 = ( A(3,4) - L31*016 - L32*024)* ¥3 L41 = 4(4,1)	Lunec	21			
L42 = 414,23 - L410U12	LUDEC	ži			
143 - 4(4.3) - 1410013 - 140013	FADEC	22	SUMMODITINE OUTPUT(L)		
199 * #{4+41 = 141+1114 =142+1124 =143+1124	FRUEC	23	COMMONICOMI SIMAN, MMAN, IM, KM, XMACH, ALPHA, GAM, GAMMI, CM, DT, SMU, IPRT,	OUTPUT	ş
	LUDEC LUDEC	24	~ UTURUARUARUDARUUARUUAAAMAUREGAANUANLATTATANATTEGAENTAATABTAATABTA	COMI	2
PETURA SAN	LUDEC	25 26	STIME GIME CINE SCS THECLUS PT MORN ON DEF MARKEN MINE	CDP1	•
:***	LUDEC	27	LEVEL ZpxpYpXETpXEXpXEYpN	COMS	Ž
			COMMIN /COM2/ X(40,20), Y(40,20), XET(40,20,2), YEX(40,20,2), YEX(40,20)	COMS	3
			1 FWF1 7-0-FF-S-C-AR	COMS	•
			CDMM14 /C043/ 0140a20a41aFFE61a1a1a5f40a20a41a6f41a4	C0#3	Š
			SIMENSION SCIENTS CONTROL	DUTPUT	í
SURROUTINE HOLPTS	HDLPTS	2	60 TO {1,2,3,4,5),L	CUTPUT	7
CPPHON/COMI/JHAX, KMAX, JR, KM, XMACH, ALPHA, GAM, GAMNI, CM, NT, SMI, IPRT,	COMI	ž	1 COMTINUE Co-oditput flowfield data	OUTPUT	
> CHIPD, NCA, NCB, NCC, AA, 4, INEGA, NU, NL, LT, TAU, ITER, ENT, PTIRT, PINF, CRPF, OTNF, CINF, JCS, TN, CLUS, PT, HORN, RNDSE, NCASE, NPINC4	COMI	3	Saza0*6	ついて P U T	. •
FEARE S'X'A' XEL' KEX' XEA' D	COME	ž	Р Е Ф Р М X • О • О	704100	10 11
COMMON /COM2/ X(40,201, Y(40,231, XET(40,20,2), XEX(40,20,2),	COPZ	ŝ	HTTNF=GAM/GAMMI OPINF/RINF+DINF+OP+O_4	DUTPUT	12
* XEY(40,20,21,0(43,20)	COME	Ă	URTTE(6,111)	DITPUT	19
LOGICAL LMERUM, LPRFL, LPRST, LPRCOM, LPRM, LPLOT, LTRAJ, LMRTMY	PP OP T	2	On 10 Kelemax	TUTFUT	14
COMMON /PPOPT/ LRERUN, EPRFL, LPRST, LPRCOM, LPRO, LPLOT, LTRAJ, LRSTRT COMMON /ALUMT/ THETA(25), RP(23, 25), NOLIMM	ee ge T	3	7M 6 J=1,j MAY EM=Q(J, K, 4) + M(J, K)	CUTPUT	1:
ConsTHIS SUBPOUTINE DETERMINES THE K AND Y LOCATIONS OF THE HODE POINTS	BLUNT	í	RMO=01J,K,11=D1J,K)	OUTPUT OUTPUT	16
174ET-1.57079633/(FLOAT(MPLUNT)-1.5)	HOLPTS	é	"1+0(1+x+2)/0(1+x+1)	OUTPUT	17 19
CoooJor FOR CYLINDER, Jol FOR SPHERE.	HOLDTS	•	Y-0(J/K/3)/0(J/K/1)	DUTPUT	i i
7ELT7=EGAMM1=XMACH++2+Z-C3/(EGAM+1-01+XMACH++23+0-78+3-C++(1-JCS)	HDLOTS	ır	P=F4"! + [FH-RH]=C.5+(U+U+V+V)	CUTPUT	50
TF(XMACH_LT.3.) DELTC=(2.02475+{XMACH-1.251++2-5.6539cf5+{XMACH- > 1.251+4.4)/4.44+JCS	HOLPTS	11	HT-GAM/JAN/JAP/RHOGO, SA(IJAUAYAY) SS-SORTEGAMAA/RHOJ	CHIPUT	21
TE (MOPH alta 6.0) GO TO 13	HOLPTS	12 17	PERG-LOS CUT-UTINE; 0100.0/MTINE	CUTPUT	22
TECHTON .LT. D.1 .AND. HORN .ST. C. JED TO LO	HOLPTS	14	TF4PE4P.GT.PERRMX) PERRMX=PERP	DUTPUT	24
ANG=93。/57。2957795	HOLPTS	15	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	OUTPUT	?5
CALL RICY(YOG, KOO, RNDSE, ANG, HIRM)	MUT-14	16	SECIJOSARTOUMINAANISS 5 COMTUNE	DUTPHT	26
PELTO-PELTD-61.2730-G.0090-EMACH)-(0.904-0.655-40*N)	NULPTS	17	00 11 J=3,J=4x	OUTPUT	27
DELT1=DELT1=(3,95-5,39408N+3,859408N+2)+Y9g PELT9=1,1+f(GAMN1+XMACH++2+2,)/f(GAM+1,)+XMACH++2)}+f(9,96+,5+4948)	401915	1. 1.	TF((St(J).LE.1.G.AMD.SL(J-1).GE.1.0).OP.(SL(J).GF.1.J.AMD.SL(J-1)	OUTPUT	5 B
10 CONTINUE	HOLPTS	51	**************************************	TUSTUO	30
DO 40 J-2.JMAX	HDLPTS	21	69 70 11	CUTPUT	31
C SHAPE	49L=T4	22	15 121-1	DUTPUT	32
THET=(FLMAT(J)=1.5)+DTMET TF (L95TMT) THET=AM2(Y(J,1),1.3-X(J,1))	HOLPTS	23	JSL M=JSL=1 C7EF=11-6-5L(JSL M))/(SL(JSL)-5L(JSL m))	DUTPUT	33
CALL MUDALAN WASHADZEALHELANDON)	49LPTS	24 25	x2F=x(12Fh'K)+COEt+(x(12F'K)-x(12Fh'K))	のりて申りて ロリて申りて	34
YA-YR	HDLPTS	26	YSL -Y(JSLM, K) +CDEF+ (Y(JSL, K)-Y(JSLM, K))	OUTPHT	35 36
C.s.seesSMTCK SHAPE	HOLPTS	27	42F = 1 * 5 + 42F	TUSTUD	37
IF (LESTET) 60 TO 20	HPLPTS	2.4	WRITE(6,11) XSL,YSL	DUTPUT	3 0
TE THORN .LT. J.GI GO TO 15	HDLPTS	30	11 CONTINUE	DUTPUT	39
TE (MORN.LT.J.) ANDA MORNAGTAC.J) GO TO 15 IE (J.AT. MALUMT) GO TO 12	NOLPTS HOLPTS	30 31	PMS=500T(PMS/FLOAT(JMAX+KMAX))	DUTPUT	40
989-DELT1 **2*(15[ 4( THET ) **2) /5[ M(T4ET ) **?/(2.+DELT))	NOLPTS	12	WRITE(5,107) PERRMY, RMS	CUTPUT CUTPUT	41
FOURAC=4.*RRS+{1.*DELTu}	HOLPTS	33	* E T 1 1 * N	CUTPUT	42 43
YA-1.+(ARR-SORT(RRB++Z+FOURAC))-5	MOLPTS	34	2 CONTINIE	DUTPUT	44
THET90-1.570796326879	HOLPTS	35	COUTPUT E AND F CONSERVATIVE VARIABLES WETTE(6,233)	זנילדוים	45
TFEETHETHTTOD .GF. C.S)XA-1.+EBR9+SQFTERRR+2+FQURAC}}+7.5 TZ YA-RELT1+SQFTEE1.+RELT3+E1EA37/SQFTE1.+RELTQ}	HŋLPTS HŋLPTS	96 37	70 7 K-1,4MAY	DUTPUT	46
40 Th 30	MOLPTS	34	UPITE(65104) K	701197 704707	47
45 CONTENTS	MOLPTS	39	00 7 J=1, JMAX	DUTPUT	10
TF 13 off MOLUMTI THET-ATAM2(VA, 10-VA)	MOLPTS	40	CALL EFCONCUPK,13	DUTPUT	56
7ELT-(1.6+,.68+THET++2+4.16+THET++4)+DELT3	HOLPTS	41	90 9 4-1,4 8 com(m)=68m3	DUTPUT	99
TF (J GT, MALUNT) GO TO 17 Y4-1-0-(1-)+DELT)+COS(TMET)	NDLPTS NDLPTS	42	SALL EFCOM(J,K,2)	GUTPHT	5?
17 Y4-(1.0+DELT)+SIM(THET)	MOLPTS	43	On 9 4=1,4	OUTPUT	51
60 TO 30	MOLPTS	4.5	4N=4+4	DUTPUT DUTPUT	54 51
EL CONTIMIE	40[-75	46	9 CONTRAL = GIM )	OUTPUT	7: 5é
TA-X(J, KMAX)	HOLPTS	47	7 WRITE(6,105) J. (COM(M), H=1,8)	TUSTUS	57
YA-Y(J,KMAX) CCALCULATE MODAL POINTS	401915	48	RETURN 3 CONTINUE	DUTPUT	5=
3C CONTINUE MUDAL POINTS	NOLPTS NOLPTS	4¢	a Cunimus Return	CUTPUT	59
FKM±K M&Y−1	MUFELL	51	4 CONTINUE	CUTPUT	`60
Dx=(x4-x4)\ZKH	HOLPTS	52	WPITE(6-139)	DUTPUT	61 62
77-(YA-YE)/2KH	HOLPTS	53	WPTTE(6,169) ((J,K,X(J,K),Y(J,K),(XET(J,K,I),XEX(J,K,I),XEY(J,K,I)	TUSTED	63
NO 40 K=1,KRAX	NOL OTS	54	> JI=1+21+N(J+K)+K=1+KNAY)+J=1+JMAX}	OUTPIFF	64
7K•K-1	MILPTS	5*	2 CUALIMIE	OUTPUT	67
			The state of the s	CUTPUT	66

egrupa	OU TPUT	67	4 VX[(J)=(V(J+1,3)-V(J-1,3))+D.5	SHOCK	25
'C3 FORMAT(140,37x,324<<<< CONSERVATIVE VARIABLES >>>>	DUTPUT	6.6	PXT (1)=-PXT (2)	\$40CK	26
174 FORMAT(3HOK+, 12//4Y, 1HJ, 6X, 2HE1, 10X, 2HE2, 10X, 2HE3, 1CX, 2HE4, 10X,	TU TPUT	69	441 (1) = -041 (5)	SHOCK	27
> 2HF1,10%,2HF2,10%,2HF3,1C%,2HF4/) 105 ####################################	ロリTPUT	70	VXI (1)-VXI(2)	SHOCK	20
107 FORMATEPINOSSES T ERROR IN HT =, E12.4,3%,224RHS OF T FROR IN HT	OUTPUT	71	C.O+ffe,mmljq+fe,mljq+g-b-fe,xamljq+0.sc-fe,xamljq+0.sc-fe	SHOCK	29
> ,E12,4,54 >>>>)		72	UXICJAKY)=C3.04UCJAKY397-4.04UCJAY31+UCGAM,37340.5	SHOCK	30
108 FRRMATCIHI, 3X, 143, 4X, 14K, 8X, 14X, 11X, 14Y, 10X, 44X [-T, 8X, 44X [-X, 8X,	OUTPUT OUTPUT	73	2.04	\$40CK	31
> 44x1-7,7x,54674-T,7x,54674-x,7x,54674-Y,8x,143/1	001901	74 75	DO 5 J-1,JMAX	SHOCK	32
109 FORMAT(215, 9F12.6)	DUTPUT	76	PETA(J)=(3.00P(J,3)-4.00P(J,2)+P(J,1))0.5	SHOCK	32
110 FOR MAT(5Ho Y SL = o F 7.4 o 3 Yo 44R St = o F 7.4 1	OUTPUT	77	UETA(J)=(3,0+U(J,3)=4,0+U(J,2)+U(J,1))+0.5	SHOCK	34 35
ILL FORMATC//26H FINAL TONIC LINE LOCATION/)	CUTPUT	78	YETA(J)=(3.0+Y(J,3)-4.3+Y(J,2)+Y(J,1))+5.5 TF(J.E0.1.0R.J.E0.JMAX) GO TO 5	SHOCK	36
END	CUTPUT	79	P(J,?)=P(J+1,3)+P(J-1,3)-2.0*P(J,3)	SHOCK	37
			S CONTINUE	SHOCK	38
			P(1,21=P(2,2)	SHOCK	39
			P(JMAX,Z)=0.0	SHOCK	40
			no 1 Jelejak	SHOCK	41
			K = R M F A	SHOCK	42
SURROUTINE RHS	*44	2	CDETERMINE SHOCK ANGLE DELTA-ARCTAN(-ETAY/ETAX) J,KMAX	SHOCK	4.8
COMMON/COMI/JMAX, KMAX, JM, KM, XMACH, ALPMA, GAM, GAMMI, CM, DT, SHU, TPRT,	COMI	?	nelta-atan(-xey(j,k,2)/xex(j,k,2))	SHOCK	44
> CHOOD, NGA, NCB, NCC, AA, M, OMEGA, MU, NL, IT, TAU, ITEP, ENT, PTORT, PINF.	COMT.	3	SD=SIMIPELTA1	SHOCK	4.5
<pre><pinf, a="" cinf,="" clus,="" comp.<="" fuel="" horh,="" jcs,="" ncase,="" npunch="" othe,="" pre="" pt,="" rnose,="" target="" th,=""></pinf,></pre>	COM	•	CD=CDSEDELTA)	\$40CK	46
LEVEL 2,0,6F,3,6,AR CDMMON /CDM3/ QC43,2U,41,6F(42,41,5C4U,23,41,6C4),ARC4,41	COM3	2	U1 T=0 INF+C7	SHOCK	47
C THIS SURROUTINE COMPUTES THE RIGHT HAND SIDE OF THE DELTA FORM	6945	3	####=#ET(J,K>1)+U(J>3)+#EX(J>K>1)+V(J>3)+WEY(J>K>1)	5400K	48
CEQUATION	PHS	6	VAAR=YFT(J,K,2)+U(J,3}+YEY(J,K,2)+V(J,3}+YEY(J,K,2)	SHOCK	49
C FORM E CONSERVATIVE VARIABLES AND DIFFERENCE. TORE IN THE S ARRAY	*44	,	RCS=GAM+P(J,3) PTAU==UPAP+PX{{J}=YBAR+PETA{J}=RCS+{UX[{J}+XEX{J,K,1}+	SHOCK	51
70 1 K-2,KH	845	÷	> Axi(1)+xEx(1)*x*10+iEtv(1)+xEx(1)*x*5)+AEtv(1)*xEx(1)*x*5)+	SHOCK	51
90 2 J-1,JMAX	PHS	ë	> (V(J,31/Y(J,K)1+FLOAT(JCS))	SHOCK	52 53
CALL EFCOM(J.K.1)	845	10	P2=P(J,3)+PTAU+DT+D,Z+D,I(+P(J,2)	SHOCK	44
กกั≱ พั∞ธ์ , 4	RHS	îı	TF(J .60. JMAX)P2=2.4P(JM,3)-P(JM-1,3)	SHOCK	3:
2 °F(J,N1-G(N)	R4S	12	1F(P2-1F-3-0) GT TT 6	SHOCK	56
Casacentral difference e conservative variable	442	13	7=6&**].ú	9400K	57
00 1 M+1,4	P45	14	\\\equiv =                                                                                                                                                                                                                                                                                                                                    \qquad	SHOCK	5.
DO 1 J=2,JM	P45 .	15	75=CT4F+XMX-U1T	SHICK	99
1 {{J,K,M}={EF{J+1,M}=EF{J-1,M}}*M	RYS	16	PA+P(J, 3)	SHICK	56
CFORM F COMSERVATIVE VARIABLES AND DEFFERENCE. AND TO PREVIOUS S	445	17	00-R( J, 3)	SHOCK	- 51
CoooARRAY	845	1.	!!#=U(J,3]	SHOCK	6?
10 3 J-2,JM 10 4 K-1,KMAY	945	19 20	VA-V(1,3)	SHOCK	53
CALL ECCUALTYK'S)	PHS	21	5n=P4/GAM1+J.5eR4*(UR+2+Y5++2)	SHOCK	64
70 4 Mal,4	945	2,	U2T-2-7-(1-4-XMX++2)+CIMF/((G4M+1-0)+XMX)+U1T	SHOCK	65
4 FF(K,N)-G(N)	945	23	42=41HF+(b2/b1HF+64HM1/23/41+3+64HM1/2+b2/b1He) 	SHOCK	55 67
C FRITRAL DIFFERENCE F CONSERVATIVE VARIABLE	P 45	24	NS= OI ME = SUGCO-NSIESD	SHOCK	
7P 3 H=1p4	245	25	E2=02/C4 mm] +u_550P20 (UZ002 +V2007)	SHOCK	56
70 3 K=2,K4	945	26	CCOMPUTE CONSERVATIVE VARIABLES AT SHOCK	SHICK	70
¿{J*k*H}=-2{J*k*H}-{££K*J*H}-F£KX-J*H}.	945	27	waxma t	SHOCK	71
3 CONTINUE	245	; ·	nt=1,3/ntJ,k1	SHECK	72
PETUPN	945		9(J ₂ K ₂ 1)=R2+DE	SHOCK	73
FN9	P45	1	Q(J, K, S, Z) = S = + (Z + DI	SHOCK	74
			O(J,K.31=P2.4V2.4DI	SHITCK	75
			0(1,4,4)=52+01	SHOCK	75
			C)ETERMINE ANGLE OF XI-COMST LINE WITH X-AVIS	SHOCK	77
			TF(4F5(YEY(1,K,1))-0.03(001) 7,7,8	SHOCK	7* 79
SURPRUTINE SHOCK	540CK	2	7 THETA=1.57379633	SHUCK	90
COMMONICOME FRHAN, KNAN, AND COMMONAL PHAN, GAMEN COMMON CONTRACTOR STATEMENTS	COMI	2	40 TO 9	SHOCK	41
> CHORD, NCA, NCB, NCC, AA, M, OMEGA, NU, NL, IT, TAU, TTER, ENT, PTORT, PINF,	COMI	3	5 CONTINIE	SHOCK	
CPINE, GIVE, CINE, JCS, TH, CLUS, PT, 4 ORN, RANSE, ALASE, APUACA	CGHI	•	THETA-ATAN(X5X(J,K,1)/XEY(J,K,1))	SHECK	6.3
LEVEL 2, X, Y, XET, XEX, XEY, D	C045	?	4 CONTINUE	SHICK	44
"ПЯМПЧ /СПЧ2/ X(4),20),Y(4C,20),XET(4),2C,2),Y=X(4U,2C,2), • XEY(4),20,2),N(40,20)	C 3 P 2		CoooGMPUTE SHOCK SPEED IN X AND Y DIRECTIONS	SHOCK	45
LEVEL 2. O.E F.S.G. AB	Luna Films	;	RETA-THETA-DELTA	SHOCK	96
COMMON /COM3/ 0(40,20,4),EF(4),43,5(43,20,4),6(4),48(4,4)	CO#3	•	05E=07/C05(8ETA)	SHOCK	47
COMMUN / PUN/ P(40,3), PX[(4C), PETA(46), U(40,3), UX[(4C), UETA(47),	PUV	ž	TFEARSTOSET .GE. ASSEQUENTIJOS-J	SHUCK	9.6
• V(40,31,VXT(401,VETA(40),R(40,3)	PILV	3	IF(ANSIOSE) .GE. ANSIQSEMIJOSE#=35E	SHOCK	• •
C DMPUTS THE FLOW VARIABLES ONE MESH INTERVAL AFLOW SHOCK	SHICK	÷	PMS-PMS+05E+02 **T=-05F005ETHETA}	SHOCK	90
0.0×2×0	SHITCK	À	YST-05E+SIN(T4ETA)	SHUCK	91
05E M= 0.0	SHOCK	•	THETA-THETA-ST-29578	SHOCK	97 <b>93</b>
J#M+JMAY-2	54DCK	10	DELTA-OFLTA-57-2957A	SHOCK	94
7KM=KMAY-1	240CK	11	*FTA-96TA-57.29578	SHOCK	95
nn 3 k-1,3	SHOCK	12	CPRIPAGATE SHICK	SHOCK	36
00 3 J=1,J*4X	SHOCK	13	Y[J, # }= Y[J, # } + XST + DT	SHOCK	97
KK=KH4X=3+K 7=3 0.0011-WK-31	540CK	15	**************************************	SHOCK	9.6
7=1-0 /Q(J+KK+1)	\$400K	15	CoooADJUST OTHER GRID POINTS	540CK	99
#{J,K}=0{J,KK,1}+D{J,KK} U{J,K}=0{J,KK,2}+?	SHOCK	16 17	70 2 K+2,KH	SHINGK	190
A(1ºK)=0(1ºKK°3)=5	SHOCK	14	ZWFAC-FLOAT(K-1)/ZKM	SHUCK	13?
E2-Q(J,KK,41+D(J,KK)	SHOCK	19	X(J, M)=(X(J, KMAX)-X(J, 1))*TKFAC+X(J, 1)	SHOCK	102
3 P[J,K]={E2-0.5*R[J,K]={U[J,K]**2+V[J,K]**2]}*GAMM2	SHOCK	20	Y(J,K)+{Y(J,KMAX}-Y(J,L))+ZKFAC+Y(J,L)	ZHOCK	103
CCOMPUTE P-XI, U-XI, P-ETA, U-ETA, AND V-ETA REGIVATIVES	SHOCK	21	2 CONTINIE 1 CONTINIE	SHOCK	104
NO 4 J=2,JM	\$40CK	22	PMS-S2RT(PMS/FLOAT(JMAXÍ)	SHOCK	105
PY[(J)=(P(J+1,3)-P(J-1,3))+0.5	SHOCK	23	V*ITE(6,1)2) IT,RMS,OSEM,JOS	2406K	136 137
UX[(J)=(U(J+1,3)-U(J-1,3))+0.5	SHOCK	24	PETURN	SHOCK	100
			•••	2 - 10 M	-4"

5 CONTINIE	SHOCK		A		
WPITE(6,103) J,P2,P(J,3),PTAU STOP	SHOCK	110	COMMON /INVARB/RK, ETA141), PMIP(41), DTIL(41), DTILE(41), DETA, TP(24) COMMON/JOE/ZLI, CFI, CFZ, ZLF, ZTRAM, DZTRAM	IDVARB	2
1UZ FORMATTIDH ITERATEDM, 14,4x,194RMS OF SHOCK SPEED-,19F11,4,9x,	SHOCK	111 112	LEVEL 2, RHO,P,U,V,W,ROP,ROBZ,VIMF,WINF,ROROH,RB,RBZ,BRPW,DTBPH,	PYARS	5
- commande sanck abstract to selladable by the s	SHITCK	iii	<ul> <li>RCT,DTDZ,DTDR,ACT,ICONST,GAM,CONST,NPEGON,RS,RST,RSPMI,RST,RSTT,</li> <li>RSPMIT</li> </ul>	PVARR	3
103 FORMATITHO, 41MMEGATIME PRESSURE DETECTED BY SHOCK AT J=,T2/ * 3X,3MPM=,1PE10-3,3X,3MPD=,3X,EIC-3,3X,5MPTAH=,E10-3)	SHOCK	114	**************************************	PYARR	;
FND	540CK	116	* ************************************	PYARR	6
			• NTDPH(24-41), BCT(41) ,DTD2(24,41),NTDP(41) , ACT(41) ,	PVART	7
			* ICONSTISO) , GAMIZO) , CONSTISO) , NREGTH , PS (43) .	PVARS	q
			PSZ(41) » PSPHZ(41)» PŠZ(41) » PŠZZ(41) » PŠHŽŽ(41) COMMON/SWARD/T» Z » PHT » DT » OP » OPHT » 7THT »	SVARA	10
SURROUTINE XIETAD (TFLAG)	XIETAD	2	4 ZENO » PT » ALPHA » GANNA » STONA » XNACH » TANEL »	SVARA	i
CHMMM/COM1 /JMAY, KMAX, JP, KM, XMACH, ALPHA, GAM, GAMMI, CM, DT, SMU, TPOT,	COMI	ž	* TAPE2 , DISK1 , ALPH , DISK2 , SIGH , MARWIT , DOOT , DOODH , ZM , TMUD , TMLD , TMW , TML , TTMW ,	SATE	•
CHORD, MCA, MCB, MCC, AA, M, OMEGA, NU, NL, TT, TAU, TTER, ENT, PTORT, PTNF, CRIF, OTNF, CINF, JCS, TM, CLUS, PT, HORN, RMDSE, MCASE, NPUNCH	0343 0343	3	* ITML » R? » P2 » NTPH1 » NTT » KP4T » NTTKP »	SVARA	•
LEVEL Zoxovaxetaxexoxeyon	COMS	į	MP41 , NP41) , NP412 , NP413 , NP442 , NP443 , MT , NT1 , NT2 , NT3 , P41F0 , NCN4E , RAD1 ,	SVAPA	7
COMMON /COM2/ X140,201,Y140,201,YET(40,20,2),YEX(40,20,2), * YEY(40,23,21,0(40,201	COMS	3	PHIF , METHOD, LAG . NAC . PING . SHITEN . STRE .	SVARR	
!EVEL 2,0,EF,S,G,AB	(.) m3	ž	POTNE, GASCON, MREAL, MEUNCH	SVLRR	11
COMMON /COM3/ 0(44,26,4),EF(4),4),S(4),23,4),G(4),AB(4,4) PO 11 K=1,KMAY	CUMS	3	COMMEN JONSTRMJ ZOLOTJNZSMOJNZADOJNXDLOT	DHSTRH	2 8
99 11 J=1,JMAX	XI ETAD XI ETAD	6	*	PARCH	•
YET(J,K,i)+0.G	XIETAD	ė	CALL SETDAT Call Geomaco, phip, npmi, 7, rr, re7, rep. 1, 1, pm, 1	HERCH	11
*ET(J***)2)=6-6 11 CONTINUE	YTFTAD XIFTAD	9 16	\$1G44+4T44(CF2)+57.29578 '	MARCH	12
Inne la-J	RETAR	ii	ICONSTIGNOO CALL INITA	MAPCH	13
THE COOCHE TO THE AND YOUR DAT AND DETA - 1	WIETAT WIETAT	12	FF (7 .6T. ZEND) GO TO 19	448CH	14 17
PO 1 K=1,KMAK	TETAD	13 14	MITER-1CO-MIENO	наесн	16
#EA(1%k%5)=(#(1%1%K)-#(1~1%K))+6°2	FIETAD	15	WPTT?(6,61)) ?TP??e=NT=1	MARCH	17 18
2 XEX(J+K+2)=(Y(J+1+K)=Y(J=1+K)+O.5	X1FTAD Y1ETAD	26 17	rall annrym(2) Do 4 DDDI=1.mITFR	MARCH	10
YEY(1,K,2)=(-3.i+x(1,K)+4.C+X(2,K)-X(3,K)1+7.5	YTETAN	18	TOMST(5)=JUDT	MARCH	26
YEY(1,4,2)=(-3,00Y(1,K)+4,00Y(2,K)-Y(3,K)+Y(1,K,K))+C,5	XY FYAD XX FYAD	5'	Concomment Automatic Stepsize	HAPCH	21
1 YENGJMANN, 23-63-00-YEJMAN, KI-4-00-YEJM, KI-4-CJMM, KII-C-5 CCOMPUTE Y-ETA AND Y-ETA	RETAD	21	TF (1901 -50- 1) 60 TO 3 TF (MODIFICONST(49))-NE-C) 60 TO 5	WARCH	?3 ?4
On 3 J=1,1MAX	XIFTAD XIETAD	?? 23	3 CALL FIGENM	MAPCH	25
00 4 K+2,KM	XTFTAD	24	TF (N7 .LT. 1.3) 60 TO 5	MARCH	2A 27
YEY(J,K,1)=(Y(J,K+1)=X(J,K-1))+0,5	XTETAD XTETAD	25 26	17*070T*07	MARCH	źá
*E*{J,1,1}={-3.6*X{J,1}+4.0*X{J,2}-X{J,3}}+9.5	MIETAN	27	OZDPH=D7/DETA 5 CONTINUE	MARCH	29
YEY(], YMAY, 1)=(3,00x(], XMAX)-4,G0x(], XM}+X(], XMN]) oc. 5 YEX(],1)-1)=(-3,00Y(],1)+4,G0Y(],2}-Y(],3})oo.5	XI ETAD	2 a 2 a	CALL DIFFR	HARCH	30 31
3 YFY(J, FMAY, 1)-(3.0+Y(J, FMAY)-4.0+Y(J, KM)+Y(J, FM, FM))+C.5	XIFTAD	30	C AND STORE IN ARRAYS USED BY CONTONE ROUTINES	PARCH	35
CoosCOMPHTE YEAR, YIAY, ETA-Y, AND ETA-Y PO 5 Kalakhak	XIETAD XIETAD	31 3?	TALL USIPH	MARCH	33 34
NO 5 Jelejamak	XIETAN	33	*F (7 .6T. 75MN) 69 TD 19 4 CONTINIE	MARCH	35
U1=1.0/(xEx(1)x')10xEx(1)x'5)-xEx(1)x'110xEx(1)x'5))	XI ETAD XI ETAD	34 3 f	19 CONTINUE	MARCH MARCH	36 37
TF(1FLAG.F0.01 GO TO 7	RVETAD	36	Commonwall Mata Required for reply of this gase is now by taped	MARCH	3.6
CossADJUST CONSERVATIVE VARIABLES RASED ON NEW MISH	YI STAD	37	RETURN	MYBLA	3 G 4 D
5 O[J,K,M1=0[J,K,N1+9[J,K]/DIT	XIETAD	3 P 3 P	610 FORMATCINI//SEX.ZOHMARCHENG CALCULATION/SEY.ZCC1He)///	MARCH	41
7 CONTINUE CONSTRUCTED JACOBIAN IS DEFINED HERE AND STORED IN THE D APRAY	TTETAD	40	21, AHSTEP NO., 4X, 19HNOWNSTREAM LOCATION, 4X, 13HROOV OPNINATE,	MARCH Markin	42
J{1*4}=Ú[[	YI ETAN	41 42	* 4491449HOCK ORDINATE/)	MARCH	43
YEY(J,K,1)=XEY(J,K,1)=DI YEY(J,K,1)==XEY(J,K,1)=DI	XITAD	43	Ç**'	MARCH	4.5
YFY[J,K,2}=-KEY[J,K,2}=NT	TETAD	44			
5 YEY(J, Y, 2) - XEY(J, X, 2) - DI C REFLECT METRICS AND DEPENDENT VARIABLES AND IT PLANE DE SYMMETRY	TT ET AD	46			
IF(IFLAN, EO. II) OF THE STATEMENT SANTANCES AND PLANE OF SYMMETRY	XI ET AD XI ET AD	47			
DO 9 K=1,KMAK	XTETAD	49	SUBBOUTTMS BADRYM(K1)	RNDOYM	2
nn=(+1,63++JCS n(1,43=0(2,4)+nn	XIETAD	5r 51	COMMUM/ENTRO/SC413,785,7FLD,ITPRT9,ITPRTF,MC455,HTD5US LEVEL 2, PMO,P,M,W,MUM,RO97,WINF,MIMF,RO9PH,R9,PA7,PPPH,DTNPM,	EA164 BATES	2
xEx(1 *K*1) =-XEX(5*K*1)	XT ET AD	5 2	<ul><li>RCT, DTDZ, DTDR, ACT, ICONST, CAM, CONST, MR SGON, RSZ, RSZ, RSPMZ, MST, MSZT, MSZ</li></ul>	PYAPE	4
YEY(1,K,1)=XEY(2,K,1) YEY(1,K,2)=XEY(2,K,2)	YISTAD Xistad	53 54		PYARR	5
YFYfl,K,2)XEY(2,K,2)	TTETAD	55	* POP(41) , ROBZ(41) , VINF(41) , WINF(41) ,	PATES	é
00 10 M=1=4 3-, 9(1=K=M)=0(2=K=M)=00	XIETAD	56	<ul> <li>POPPH(61) , PR(61) , RRPH(61) ,</li> <li>DTDPH(24,61) , BCT(61) , DTD2(24,41), DTDP(61) , ACT(63) ,</li> </ul>	PVARA	7
9 0(1,K,3)=-0(2,K,3)+DD	XIETAO	57 58	<ul> <li>* **ICOMST(50) ** GAM(20) ** CONST(50) ** NR2GON ** R5(41) **</li> </ul>	PVAPS	9
8 CONTINIE Petupa	CATSIX	59	* PST(41) , PSPHT(41), RST(41) , RSTT(41), RSPHTT(41) COMMON/SPARATAZ , PHI , DT , DC , DMI , ZT/R	PVARR	10
END	XIETAD XTETAD	60 61	* TEND , PT , ALPHA , GAMMA , TIGHA , MMACH , TAPEL ,	SVARR	3
			* TAPEZ » DISK1 » ALPH » DISK2 » SIGH » H*PHT » DINT »	SVAPR	4
			<ul> <li>TTML » PZ » AZ » NIPML » NIT » KPHI » NITER »</li> </ul>	SVARR	é
			<ul> <li>MPHT , MPHI1 , MPHI2 , MPHI3 , MPHI7 , MPHI7 , MPH ,</li> <li>MT , MT1 , MT2 , MT3 , PHIFT , MCOME , RANT ,</li> </ul>	SVARR	7
SURROUTTHE MARCH			<ul> <li>METHOD, LAG, NSC, PINF, RHITER, UINE,</li> </ul>	SVARR	ë
- The Thereti	MARCH	ž	PGINF, GASCON, MREAL, NPUNCH	SAV.	10

	BININGTON BUILDING BUILDING BUILDING BUILDING					
	DTMENSTON PK13(41),PK14(41),PK21(41),PK22(41),PK23(41)	BMDRYH	6	C. RESET BODY VARIABLES TO THOSE CALCULATED BY ABBETTS SCHEME	SHORYM	91
	ARSTN(A) *ASIN(A)	940674	7	DO 15 K=3,NPHI	BHORYM	92
	40 to (10)18/11)/KI	BNORYM		P(3,K)=PK13(K)	BHORYM	93
• •	CONTINUE	84 DRY#	9	PHO(3,K)=PK14(K)	SHORYM	94
10	SUNITING	BNDRYH	10	1143ex3=PK21 (K)	BHORYM	95
Coows	AK OR SMALL ANGLE CORRECTIONS (USES PRANDTL-MEYER RELATIONS)	8H0RY4	11	V(3,K)#PKZZ(K)	BAAUN	96
	PK4=1.0/SQRT(RBZ(K)++2+1.0+(BAPH(K)/44(K))++2)	BHDRYH	12	W(3,K)=PK23(K)	MNDRYM	97
	PK1==0R7(K10PK4	9H 0R Y H	13	12 CONTINUE	BMDRYM	99
	PK2 • PK4	BHORYH	14	an to 21	BHORYM	99
		840RY4	15	TB CUNTIMIE	BHORYM	100
	OK3Q9OH(K}/R9(K)+PK4 TT2MD=+FALSE+	BHDRYH	16	c	<b>LAUGAA</b>	101
		BHORYM	17	C. APPLY REFLECTION PRINCIPLE AT PLANES OF SYMMETRY	BNDRY	192
	020-013*x)**b+A(3*x)**5+A(3*X)**5	BNDRYM	18	c c	BHULLA	103
	TF(P(3,K).GE.P.G) GO TO 4	BHDRYH	19	Pg 1 K=1+2	R NOQ YM	134
Cooke	GATIVE CURFACE PRESSURE ICHECK=1	RNDRYM	20	M = 6 - K	BAUBAN	105
		ANDRYH	23	E=NPH[+K	<b>UNIONAN</b>	106
	**1.C-7  IF (K .EO. 3) WRITE(6,1()) **,P(3,K),R49(3,K),H(3,K),V(3,K)	840044	3.5	M=NP4T-K	RMIRYM	197
		BHNRYH	23	70 1 J=3,4T2	BHORY	100
	9(3,K)=P[MF*(1,-Q,5*GAMA)	840444	24	PHOCO-REPORT - RE	9498Y4	179
	PHO(3,K)+(P(3,K)/S(K))++(1,C/GAN4A)	84 D8 Y 4	? ?	#NU(101)=#NU(104)	ろい ひくてい	110
	Q3K+50RT(1.0-P(3,K)/RHO(3,K))	BNDRYM	26	P(J,K)=P(J,M)	RHDRYH	111
	11(3,K)=U(3,K)+Q3K/Q5Q++C.5	44.08.44	27	P(J,L1+P(J,N1	BNORYM	112
	V(3,K)=V(3,K)+03K/050++6,5	8404AH	5.8	U(J,K)=U(J,H)	■ 所 ひる 人 点	113
	\(3,K\=\(3,K\)+Q3K\Q\$Q++?\$	RHORYH	5.0	HEJAL FAHEJAN)	ÿ# US A N	114
	2.04114116	<b>SHOOLA</b>	30	V(J,K)=V(J,H)	84 DRY4	115
•		BHDEAN	31	V(J,L3=V(J,N)	SHDRYH	116
	TERMO(3,4) .GE. 0.0160 TO 5	ON DRYM	32	A(1*k)==M(1*H)	BMUSAM	117
	ICHECK+S	BHUBAN	3.3	WEJ, Lime WEJ, Ni	HADRAN	117
	Y+3.6;-7	94 DR YM	34	M(1+31+2+2	BMUBAA	119
	TF (K .EO. 31 WRITE(6,100) X,P(3,K),RHD(3,K),U(3,K),V(3,K)	44.06.44	35	41744413=2*0	BHUKAN	150
	9HU(3'K)=(b(3'K)\2(K))+6(1'0\UVUH)	AN DR YM	3.6	1 CONTINIE	RHORYM	121
	03K-S9PT(1.0-P(3,K)/PH3(3,K))	BNDRYT	37	ST COMITME	BHUSYM	152
	11[3,K]=!![3,K]+03K/050++0.5	4 M OR Y 4	38	1. : FORMATCIME, ASHNEGATIVE PRESSURE OF DENSITY ON SODY DETECTED BY .	ちゅうちょ し	123
	V(3,K)+V(3,K)+Q3K/Q5Q++C.5	BAUBAA	39	* 11494ORY AT x=,F7,9/3Y,3499=,19E17.3,3Y,540400=,E10.3,3Y,	9 M D Q Y Y	124
	W(3,43+W(3,K)+03K/050++(.5	BHÚBÁd	40	* 44447=,:10,3,3%,44468=,E1C,3;	BNDRYY	125
5	CONTENUE	PA DB A A	41	PETURN	RMORYM	125
	PK5=SORT(QSO)	940544	42	FND	9 NO PYN	127
	PK6={PK1= '{3,K}+PK2+Y{3,K}+PK3+W{3,K}}/PK5	BHORYM	43			
	ox4.ve2In(ox9)	4444	44			
	PKA-644(1)+P(3,K)/RHO(3,K)	84 0844	45			
	P44*D42*05/PKP	440654	46			
	9410-949-1-0	Ed D6 Ad	47			_
	1 F( 0 K1 U . 6T. 0.0) GO TO 6	440634	4.R	THERETHE DEFE	DIFFR	Z
	1CHECK+3	PHDRYM	49	LEVEL 2, ETEMP, EC, FO. GG, ML	CVARA	2
	Y=1.C+7	84 JB 4 4	5 ^	GGMMGM /CVARB/ ETEMP(4,24,41), E0(4,24,41),	CANER	3
	TF (M .EO. 3) WRITE(6,100) Y,P(3,K),RHO(3,K),U(3,K),V(3,K)	****	51	• Fulfa,24,411 , Gilfa,24,411 , M^(4,24,41)	PVARR	
	PK10+0.	PHORYM	52	1EVFL 2, PHO,P,U,V,W,ROB,RORZ,VTNF,WINF,RORPH,RR,PRT,RRPH,OTOPH,  B. BCT-OTO7.OTO8.ACT-ICONST-CAM-CONST-NB-COW-RS-257.DSBHT-DST-RS-TT-		2
	PK9+1.5	64 06 44	53	<ul> <li>ACT+NTD7,DTNR,ACT+ICOMST+GAM,COMST+NPEGOM+RS+RSFHE+RST+RSTT+</li> <li>BROWLT</li> </ul>	PVAPS	3
	PK#+PK5++2/PKG	8406A4	54		PV 4 9 9	•
	9HO[3;K]=GAM(1)+P(3;K)/PK8	SM US A W	55	**************************************	PYARR	5
	03K=50RT(1.0-P(3,K)/RHO(3,K))	SHUBAN	56		PATES	2
	11(3, ×1+11(3, K)+03K/05Q++C.5	BHDRYH	57	• PO9PH(41) , R9(41) , R97(41) , RPPH(41) ,	PYARR	7
	V(3,K)=V(3,K)+03K/050+0.5	94 DQ Y4	7.8	* OTDP4(24,41), ACT(41) .OTO7(24,41).OTOP(41) , ACT(41) , ** TCT45(5) . GAMESON . CONSTANT . MESON RS(41)		-
	413'KJ=A13'KJ+63K\626+6".	SHUBAn	50		PVARR	
6	CUNTINUE	ed ûs An	90	<ul> <li>PSZ(41)</li></ul>	PVARS	10
	PK1] = GAMMA*PK9/50RT(PK16)	SMDD YM SMDD YM	61	COMMUNICATION , OH , OT , OF , OPHI , ZINT ,	SVAPR	?
	PK12=GAMMA*PK9*(GAMMA+1.C)*PK9**2-4.3*PK10)*(4.C*PK1C**2)		62	* TEND , PI , ALPHA , GAMPA , SIGMA , MACH , TAPFI ,	ZAVes	3
	PK13(K)=P(3,K)=(1.0-PK11+PK7+PK12+PK7++2)	BHDRY4	63	* TAPEZ , DISKY , ALPH , DISKZ , STOM , MPRHT , DISKY ,		
	FACTOR-0.5*GAMMA*PKG/(PK10**3.5)	BMDRYM	64	<ul> <li>PROPH , 7M , TMWD , TML , TML , TML , TML , TML ,</li> <li>TTML , P7 , R2 , NIPMI , NIT , KMI , MITER ,</li> </ul>	SVAPR	•
	TEPM1=(GAMMA+1+0)+PK9++4/6+0 TEPM2=-(5++7-4+6AMMA+2+)+GAMMA++2)+PK9++3/6+0	BN DO YM	65	<ul> <li>TTML j p7 , R7 , NTSWT j NTT j KONT j NTTED j</li> <li>MPHT , NPULL , NPULS , NPUMS , NPUMS , NPUMS , NPUMS ,</li> </ul>	SVAPE	6
		RNDBAN		+ NT , NT2 , NT3 , PHIED , NCOME , RADI .	5445	Á
	TERM3= 5.00(GAMMA+1.0)+PK9++2/3.0 TEPM4=4.0/3.0-2.00PK9	5N0RY#	67 68		SVARR	
	COEFF3=FACTOR+(TER41+TERM2+TERM3+TERM4)	RN 20 YH		<ul> <li>PMTF , METHOD, LAG , NRC , PTNF , RHGIN , HINF ,</li> <li>COTHF, GASCON, NREAL, NPUNCH</li> </ul>	SVARR	10
	D1E21-bk13(K)-b(3'K)-CUEEE3-bK4-93	84084a	69 70	CFORM CONTERVATIVE VARIABLES AT ALL POINTS	Dites	16
		ANDS AA		ratt Tornito	ULEEB	ř
	TF (ART(*KT).LT.AST(G.D1))60 TO 123 YM1 - TOPT(PKG)	BNUBAH	71 72	10 1 K=3,HPHT	DIEFE	ģ
	CALL PHTURN (XM1, PK7, P2P1, MTTS, GAMMA)	SNDRYH		ng 1 J-3, NT2	DIFFR	3
	PTRIS - PI3,K)+P2PI	ANDRYM	73 74	77 1 441,4	DIFFR	11
	PTEST - PTRUE	ANDRYM	75	TF(J. 20.NTz) on Th 2	DIEFE	ii
1 22	CONTINUE	440874	76	CPREDICTOR STEP AT PORY AND IN FIELD	DIFFR	iż
42	PK13(K)=PTEST	940844	77	*TEMP(N, J, K) = EU(N, J, K) = (D?DT*(FG(N, J+1, K) = FO(N, J, K))	DIFFR	15
	bk346K)={bk73(K)\26K))++{1*C\2vuvv}	RM7874	76	+ +DSDPH+(GD(N) 1 * K+1 1 - G)(N, 1 * K) 1 +DZ +HC(N, 1 * K) 1	DIFFR	
	*#15=SQT(1.0-PK13(K) /PK14(K))	347874	79	en 14 1	DIFFR	14
	0K19=0K90K20EK4	84 08 44	96	2 CONTINUE	Ditte	16
	PK17-U(3,K)+PK16+RR7(K)	RNORYN	61	CPREDICTOR STEP AT SHOCK	DIFER	17
	PK18=V(3,K)-PK16	RNDRYM	92	ETEMP(M,J,K)=EU(M,J,K)=(D2DT+(FQ(M,J,K)+FQ(M,J-1,K))	01558	10
	PK19-W(3,K)+PK16+R8PH(K)/RP(K)	BHDRYH	93	* * * * * * * * * * * * * * * * * * *	Oltes	10
	PK20=5QPT(PK17++2+PK18++2+PK19++2)	RNDRYM	94	en to 1	DIFFE	20
	PK24-PK15/PK20	RNDEYN	45	1 CONTINUE	DIFFR	21
	PK21(K)-PK24-PK17	PNDRYM	96	7=7+07	01660	22
	PK22 (K1 = PK2 4 + PK1 R	RNDRYM	97	CDECODE COMSERVATIVE VARIABLES	DIFFE	23
	9#23[K]=PK240PK19	9479 74	áė	CALL INCON(2)	ülese	
9	CONTINUE	SNDRYS	19	CCALCULATÉ PREDICTED SHOCK VALUES	DIFFR	24 25
iì	CONTINUE	RNDRYH	90	CALL SHOCKH(1)	DIEFE	24
			-			

CCALCULATES GEOMETRIC FACTORS RASED ON MEW MONY AND SHOCK GEOMETRY CALL GEOMITS	DIFFR	27		DISSPA	22
C APPLIES PLANE OF SYMMETRY ROUNDARY CONDITIONS	DIFFR	28		MAZZIO	23
CALL SUDDYHIZE	Ditte	29		DISTPH	24
C FORM INTERMEDIATE CONSERVATIVE VARIABLES AT ALL POINTS	Diete	30		NTSSPH DISSPH	25 26
. er toroatti	DIFFE	31 32		DISSPA	27
NO 3 KPHI=3,NPHI	DIFFR	33	1F(3.LT. 4160 TO 70	DISSPH	28
DO 3 403,472	DIFFR	34	TH = 9L	Messig	29
70 % 4=1,4 K=KPHT	DIFFE	35		DISSPH	30
CDISTPATION FUNCTION	Diezs	36		DESSPA	31
n155=0.e	Ditte	37		DTSSPM	32
IF (CONSTEAD. NE.C.D . DR. CONSTESD. NE.C.O) CALL DISSPHIN, J.K. DISS)	Ditto	3 6		DISSPH	33
1773-703) 60 70 q	Ditte	35	60 DISS==CDMST(4)+(.125+(ED(N,J0+1,K)+FD(N,J0-1,K))-0.25+ED(N,JD,K)) 60 TO 2	D13374	34 35
TF(J. E0. NT2) 60 TO 5	DTERD	41		DISSPH	36
C CORPECTOR IN FIELD	DIFFR	42		n15594	37
FTENO(N.J.K)=C.SO(EO(N.J.K)+ETEMP(N.J.K)-(NZNTO(FO(N.J.K)	DIFFR	43		D1 55 P4	3 8
*-F0(N,J-1,K))+020PH+(60(N,J,K)-F0(N,J,K-1))+07040(N,J,K))+01553	Ditte	44		DISSEM	30
5 CONTINUE	DIFFR	45	C CONSTESS = 0 . MO DAMPING	D155PH	40
CCOPPECTOR AT SHOCK	Ditte	46	C COMST(5)>O p 4TM DPDER DAMPING	OTSSPH	41
FTFMP(Najak)=0.50(FTFMP(Najak)ak)ak).u.a.m.a.m.a.m.a.co.m.a.m.a.m.a.m.a.m.a.m.a.m.a.m.a.m.a.m.	DIFFE	47	c	DISSPH	42
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	DIFFE	49	•	0155P4 0155P4	**
	Dired	50	Z TF[CONSTISTITES] 11.03.11 C+++015STPATION TERM IN THE MEPTDIAMOL DIRECTION	DESEN	45
9 CENTENIE	DIFFR	51	37 CUNTENNE	DESSER	46
CCTOPECTOR AT 800Y	Ulted	52	TERM SEE, 4 SANDS K SLES NEMMINGS TO BO	DISCOA	47
FTEMP {4, J, K}=C.5+(ETEMP(N,J,K)+EO(N,J,K)-(NZNT+(FO(N,4,K)-FO(N,3,K)	Ditte	53	TFEX -LT. 4160 TO 100	PRZZZO	48
*1+D7DP4+(GD(N+3+K)-GE(N+3+K-1))+DZ+43(H+3+K))+DZS)	DIFFR	54	KT-sub-um (	DISSPR	49
	DIFFR	55	60 TO 9;	DISSPH	25
C DECODE CONCERVATIVE VARIABLES	Ulted	36 57	16. KD=4	N9777N	51 52
CALL IOCON(2)	71558		GN ₹^ 90	DISSPA	55
C CALCULATE CORRECTED SHOCK VALUES	DIFFR	59	9( 0[779=_CN457[5]+(=125+(E; (N, J+KD+1)+E0(N, J+YD-1)}-0+75+EC(N, J+KD))		94
CALL SAUCKA(2)		66	60 TO 4	D145 P4	55
Co-FALCHLATES GENMETRIC FACTORS BASED ON DLD BODY AND NEW SHOCK GEOMETRY CALL GEOMICS)	Diets	51	II CUNTINIE	PESSA	56
C RESFTS ANNY VARIAGLES	DIFFR	52	TF(K.=0.3) P(J.1)=P(J.5)	ULCCHH	57
CALL ANDOVECTS	Uleca	63	TECK-50.NPHI) PCJ-4PHIZ)=PCJ-4PHHZ)	DISCOM	59
CookPPLIES PLANE OF SYMMETRY ROUNDARY CONDITIONS	DIFFR	65	pt1-84c(s(1)k+5)-5*A+s(1)k+1)+b(1)k))\(s(1)x+5)+5*g+b(1)k+1)+b(1)*	M4223U	5 Q
CALL MINERALS	DIFFR	66	0)) 0F2-4E5(0(1,4+1)-2.00P(1,K)+P{1,K-1)}/(0(1,4+1)+2.00P(1,K)+P(1,K-1		61
P = TUP N E NO	Dista	67	## ## ## ## ## ## ## ## ## ## ## ## ##	014204	62
£ 4.1	ULEED	6.8	5-7.411-7.417490.54f7461911(f5-7.41)44ff-7.47946C.5-f7.4791912p44ff	P42230	63
			*))	P42277	64
			01550=355/DEA+(CPF1+PF2)+(E0CN,J,K+1)+E0(N,J,K)1+	DESCH	65
			<pre>+ (PE2+0F3)+(E6(N,J,K)+E0(N,J,K+1)))+C0NST(*)</pre>	D1225M	56 67
SUMMOUTINE DISSMAN, J.K. DISSI	P42210	2	an 10 4 3 91552=0.0	015594	4.0
LEVEL 2,ETEMP,EU,F3,60,40	CHAPS	•	4 NISC+DISSP	NYSSPH	69
COMMON (CVART/ ETEMP(4,24,41), E3(4,24,41),	CVARR	á	QETURM	NISSPH	70
* F3(4,24,41) , G1(4,24,41) , M1(4,24,41)	CVAPR	Ĭ.	a in the second	0124bm	71
COMMON ATOVARRANK, ETA (413, PHIP (411, DTIL (411, DTIL E(41), DETA, TP (24)	IDVARG	2			
LEVEL Z. P4O, P, U, V, W, ROR, RORT, VINF, WINF, RORPH, PA, RSZ, RRPH, DTDP4,	PVAPR	2			
<ul> <li>ACT,DIDT,DIDR,ACT,ICOMST,GAM,CONST,MRFGOM,RS,RST,RSPHI,PST,RSPT,</li> <li>PSPHIT</li> </ul>	PA 764	3			
COMMON /PVARB/ RMG(24,41), P(24,41), U(24,41), V(24,41), V(24,41),	6 A T 6 d	•			
• PO9(41) , PO97(41) , VINF(41) , WINF(41) ,	PPAV0	6	STREETITINE EFGENE	FERENA	Z
* * ** ** ** ** ** ** ** ** ** ** ** **	PYAPR	ž	COMMON/CLUSTR/RJ, XI (24), TXI (24), TXI T(24)	CLUSTR	Z
<ul> <li>ntr=4(24,41), nct(41), ntoz(24,41),ntox(41), act(41),</li> </ul>	PAVES	•	TOMMON /EDVARR/RK,ETACALI,PHIPCALI,DTLLCALI,DTILECALI,DETA,TPCZAI	TOVARB	Ş
<ul> <li>* TCOMST(50) , GAM(20) , CONST(50) , MREGON , PC(42) ,</li> </ul>	PVARS		LEVEL 2, P4(D,P,U,V,W,R)9,R)9,R195,X1NF,X1NF,R1994,R4,R47,R87,R87,R4,NTNPM,	PA VS 3	2
• RS7(41) , RSP4T(41), PST(41) , RS7T(41), PCPHTT(41)	****	10	• RCT-PTDP+ DTDR+ACT+ICONST+GAH+CDNST+NREGDH+RS+RRZ+RRPHT+RST+RSZT+	PVARS	3
COMMON/SYARSIT,Z , PHT , CT , OP , OP , ZINT	PALVE	Ş	- PSP4TT - 10PMCH PH3(24,41), P(24,41), U(24,41), V(24,41), V(24,41),		
	SVAPR		• ************************************	9444	,
<ul> <li>TAPEZ , DISK1 , ALPH , DISK2 , SIGM , NPRNT , DZOT ,</li> <li>DZOPH , ZM , JMWD , TMLD , TML , TTWW ,</li> </ul>	SATE	:	<ul> <li>PORPH(41) , RB(41) , PRZ(41) , PRPH(41) ,</li> </ul>	PVARA	,
* TTHL . RZ . RZ . MIPHE . MIT . KPME . MITER .	SYARR	é	• 070P4(24,41), 9CT(41) ,DTDZ(24,41),DTDR(41) , ACT(41) .	PVARS	8
• MP4I , MP4II , MPHI2 , MPHI3 , MPHI4 , MP4II , MPHI3 ,	SVAPR	Ť	<ul> <li>+ [C34ST(50) = GAM(20) = C3MST(50) = NREGON = RS(41) =</li> </ul>	PVARS	9
• ICAR & BNCON & CTN & STN & LTN & TTN & T	SVARR	9	• • • • • • • • • • • • • • • • • • •		10
* PHIF , METHOD, LAG , MBC , PINF , RH3IM , UJNF ,	ZATAd	9	COMMON/SYARB/T,Z , PMT , DT , D7 , DPHT , ZTMT ,	RPAYP	2
+OTHF, GATCON, MREAL, MPHINCH	SVARR	10	<ul> <li>TEND , PI , ALPMA , GAMMA , SIGMA , WHACH , TAPE1 ,</li> <li>TAPE2 , DISK1 , ALPM , DISK2 , SIGM , MPRNT , DZOT ,</li> </ul>	54483 54483	3
·	013354	,	+ ngnow, zw , THAD , THER, THE , THE , THE ,	SYAPA	:
C CONST(4) O . LAX DAMPING	71 13 PM		* TTML , RZ , BZ , NTPHT , NTT , KPHT , NTTER ,	SVARA	é
Cooper CONST(4)=0 , NO DAMPINE	015594	10	+ NP4E , NP4E1 , NPHE2 , NPHE3 , NPHP1 , NPHP2 , NPHP3 ,	SVAPS	7
Conses CAMST(4)>) , 4TH ORDER DAMPING	0155 04	ii	<ul> <li>HT , HT2 , HT3 , PHIFD , NCOME , RADI ,</li> </ul>	ZATES	•
Ç ,	DISSPH	12	+ PHTF , METHOD, LAG , NAC , PTHF , RHOIN , UINF ,	SYARR	. •
	0122=4	13	*athf, GASCON, NREAL, NPUNCH	SVARR Etgena	14
1F(CON5T(4))21,1,2)	DI35P4	14	CK4-1 IMPLYS EIGENVALUES AND STEPSIFF TPPNT-ICONST(4)	FIGENT	?
CoTISSTPATION TERM IN THE RADIAL DIRECTION 20 FF13 -GE. 5 -AND. J -LE. NTIGO TO 5	0155P4 0155P4	15 16	\$12154-0°C	& E C C HW	•
TETJET OF TO TO T	015504	17	CT634 Me() • O	ETSEUM	16
TH+0L	D155P4	14	DO 1 K-3, NPHI	ė į cėna	11
SP TO 6	DESSPH	19	nn 1 Jea-MT2	EIGENN	12
7 JD=5	DESS PH	20	T-XI()) q=T+(R7R(K)-Q6(K))+RR(K)	ELCENU Elcinu	13
GO TO 6	Dizzad	21	é — i a g u, ju d a 3 aug G d M à b a u u d a 3	E 1 85 44	

, **

	C2-GAM(1)+Pf3,K)/R4Of3,K) TF(C2) 17,17,18	EIGENM	15 16	LOGICAL LGRAY	NUSTO
7	CONTINUE	EIGENM	17	C CHMON/MUSOD/XX(100), YY(166), MSOD, LGRAY	<b>MUPTO</b> <b>GETH</b>
	C5=-C5	ETGENM	16	CFUNCTION DEFINITIONS	6E04
.e	CDNTEMUE C-SOPT(C2)	EIGENA	19	C	CELM
	49-079-H(J, K)+(ROB(K)-40(K))/B	EIGENM EIGENM	20 21	E(A)=EXP(-ABS(A-RMOSE)/H)	GETH
	01 - (V(1 - K) - W(1 - K) - BP) -U (1 - K)	ETGENM	žž	F(A,R)=.5+A+((SIN(2,+B)-2,+SQRT(E(A)-E(A)++2))/(E(A)-SIN(R)++2)} C(A,B)+ABS(A+((A++6+SIN(B)+COS(R)+SQRT(A++6-1,+))/(A++6+COR(B)++2-1)	GEOM GEOM
	GUUJ-U(1,K) **Z*(1,2*8P**Z)*(V(1,K)*V(1,K)*RP)**Z-CZ*(1,0*PP**Z)	ELCEMM	23	· 1.0111	e ium e ium
9	TF(Gnn1) 19,14,20	EIGENM	24	F2(A, A, C, D) = 4 + (B + C - SORT(D + (1 D)))/(D - R + 4)	e E DM
•	6701==6001	ETGENM	25 26	F3(A, R) = EXP(-ABS(11./A)/R)	GECM
	T=j=2	EIGEWM	27	ConsoleM oNE. Dat & IONOPAUSE FOR AMONMAGNETIC PLANET	GEOM
	TE (4 .EO. 3) WRITE(6,1G3) I	EIGENM	29	Cossee 4 .EG. O.D & EQUATORIAL PLANE FOR A MAGNETIC PLANET	GEDM
L	05+C+20+1(001)	EIGEN4 Figen4	29 30	E .	CÉUN
	03-U(J,K)++2-CZ	EEGENA	31	TF(H .FQ. D.UIGR TD 10 TF(H.LT.Q.O) GD TN 26	6 E DM
	51641-101-021/03	ETRENA	íż	TF (4 .LT. 0.01) 60 TO 30	GEUM GEUM
	\$1602+(01-02)/93	EIGENM	13	C	GETH
	GNN2=H(J,K)++2+4(J,K)++2-C2 TF(GNN2) 21,21,22	ETGENM Etgenm	34 35	CTHES PETERMINES THE BODY SHAPE OF A HONNAGHETTE PLANET	CEUM
:	CONTINUE	EIGENM	36		GEDM GEDM
	6002*-6002	EIGENM	37	1944-233	CENA
	Teje?	ETGENN	38	PI-3.1415926535898	CEUM
2	TF (K .EQ. 3) WRITE(6,1U4) T	E I GENN E I GENN	39 40	PANT-190./PT NELTAT-ANG/RADI/FLUAT(IMAX)	6604
-	94+ ((J,K)+W(J,K)	ELGENA	43	THETA == 1/2.	GED#
	95=C+SQ+T(G092)	ET GEN4	42	R1=R00	6404
	\$1693+(04+05)/03/P+NTIL(K)	EIGENM	43	TE (1.08AV) 60 TO 40	6504
	TIGB4=(04-05)/03/R*OTIL(K) bookcompute local T and PHT ETGENVALUES	ET GENA	44	C CPERFORM AN INTEGRATION FROM 2 TO 172 DEGREES	GEOM
••••	SIG1+495(()TOZ(J,K)+SIGB1+DTDR(K))+TXI(J))	EIGENM	44	<b>.</b>	SEU4
	\$\faz=&q\${{0}}\fo\fo\fo\fo\fo\fo\fo\fo\fo\fo\fo\fo\fo\	ETGENH	47	75T4(1) +0+0	GEO4
	\$1G12=AMAY: (\$1G1; \$1G2) \$1G3=A9\$(\$1G93)	FTGFN4 ETFRN4	40	9711)=PGT Thetal=Theta	e E UM
	\$164=49\$(\$1694)	STGENY	50	0807(1)=F(P1,THETAL)/R1	6E04
	<pre><!--g34=4MAY1(SIG3,SIG4)</pre--></pre>	ET GENM	51	J•7	CEDM
	Tettigis*Fetigish) ed to s	ETGENM	52 53	! MAX M 1 = ; MAX - 1	CÉ UM
••••	**************************************	EIGENA	54	nn s teletherm: CPPEDICTOR	CEU4
	KMWAAS	ETGENA	55	P=#1+761TAT#F(R1,THETA1)	6504
	41215 de 41215	EIGENH	96	THETA-THETA+DELTAT	65.04
	TCONST(11)=JMAX1	EI GENM	57 5e	CCnee Er 108	e E ud
	TCOMST(12)=KMAX1	ETGENN	59	P=P1+0.5+DELTAT+(F(P1,THETA1)+F(R,THETA)) DPDTH=F(R,THETA)	6604 6604
	TF(\$1634-LE-\$1634H) GD TO 3	ETRENN	65	9; = 9	e € Um
••••	bLTCATE MAXIMUM U-W EIGENVALUE	EIGENA	61	THETA 1=THETA	€ É De
	KMANZ-J	etgen4 etgen4	62 63	75T4(J)==0+0CD5(TMETA) 87(J)=0+0+5TM(TMETA)	GEUM GEOM
	TCDMST(131=JMAX2	ETGENA	64	ORDITAL CORDINGTINGTHETALER COSCINETALE!	GE 04
	TONNETE143-KMAX2	EIGENA	65	* f-DRDTH+CDS(THETA)+R+ <in(theta))< td=""><td>GEUM</td></in(theta))<>	GEUM
	SIG34M-SIG34 CONTINUE	FTGFN4 FTG5N4	66 67	J+1+1 5 CONTENUE	CEÚM
1	CONTENSE	ETGENH	64	MWX+1-1	GE DM
	www.commits stemsite mased on maximum figenvalue	ET GEN4	69	PETUPA	GE PM
	0712=0T+C045T{9}/5IG124	E I GENM E I GENM	70 71	<u>c</u>	GEOM
	7734=75TA+CONST(9)/S1634* TF(7212-6T-7734) GO TO 4	ELUCHA	72	C USE CYLINDRICAL RODY FOR HIRD .LT. 0.01	6 E DM
	97DT=C9NST(9)/S[612H	ET GEN4	73	33 7574(1)=1.3	CEU4
	ባያ=ባያባ፣ቀበኛ	EIGENA	74	75T4(2)=135.6	SERM
	77094-07/06TA TCDNS7(13)-174-1CDNST(13)	et genm Et genm	75 76	#7{1}=#90 #7{2}=#90	GE 04
	[[nny[13]=1]G=1CUNS[113]	ETGENN	77	0802(1)=0=0 e7(2)==0=0	GED4
	SO TO 5	EIGENM	76	PR97(2)=0.ú	CEUM
,	CUALINIE	ETGENA	79 80	WMAX#2	E E U-4
	970P4=CNNST(9)/\$IG34M 97=970P4+DETA	EIGENM	91	RETURN AC CONTENIS	GEO4
	^2^T-07/0T	EEGENM	62	C CONTENSE	GEN4
	CONSTELLI-100+CONSTELLI	ETGENA	53	Conside THIS DETERMINES THE BODY SHAPE OF A MAGNETIC PLANET	EE JM
,	ICONTTAUE	FIGEN4	84 85		GFDM
'	RETURM	EIGFNM	46	( J•1	CEUM
1.3	FORMATELMS, ALMMEGATIVE SIGNA-MAR-1 IN EIGENM INDICATES >	ETGENM	87	4 NC=4 NC+0C+	GERM
	• 19454850NIC FLOW AT I++IZ)	ETGENN	99	TMAYe 35 C	GEOM
24.4	FORWAT(1MG,41MMEGATIVE SIGMA-BAR-2 IN EIGEMM IMDICATES ,  1945UBSCHIC FLOW AT I=,I2)	ETGENM	89 90	PT=3.1415926535898 RADI-180./PT	4604
	\$MU	ETGENA	91	DELTATEAMG/RADI/FLDAT([MAX+1)	650M
				TMETAOPT/?.	GE DM
				9] +RHOFF	GE NY
				t contract the second contract to the second	SE Lid
				Casasa PERFORM AN INTEGRATION FROM ON TO 243 DECREE	
				CPERFORM AN INTEGRATION FROM 90 TO 260 DEGREES	GEOM GEOM

17										
0		THETALTHETA  ORIGINAL TATOGERI, THETALS	GE	04	87			*****		
	_	THETA-THETA+DELTAT	GE GE	O4	90			SUBROUTINE GEOMICKS) COMMON/CLUSTR/RJ,XE(24),TXE(24),TXET(24)	GEOM1 CLUSTR	2
	C	**COMPECTOR  ***********************************	ee.	• -	8 9 90			COMMON FIDVARBERK, ETAIG1), PHIPIG11, NTIL (G11, NTIL ELG11, NETA, TRESAL	IDVARA	2
		DWD14m6tK)TMETA)	6E	D4	91			LEVEL 2, RMO, P,U, V, W, ROR, ROBZ, VINF, WINF, ROBPH, BRRYZ, RBPH, OTDPH, RCT, DTDZ, OTDR, ACT, ICONST, GAM, CONST, WREGOM, RS, RSZ, RSPHI, RST, RSZT,	PVARB	2
		F THETA .LT. PI) GO TO 15	66	ry M	92 93.			4 #2h4[1	B V 48 B	i
		PTE 11 ROSTHET HET AS	GE:		94			COMMON /PVARR/ RHO(24,41), P(24,41), U(24,41), V(24,41), W(24,41),  ***ROR(41) **, ROR7(41) **, VINF(41) **, VINF(41) **,	PYARS	5
		PRDI(J)=(+DRDTH+CDS(THETA)+BACTHITHETALL	ĞĒ	Ď4	95 96			T TDTPH(41) . PR(41) . PR7(41) . PR96(41) .	PYARS	7
		+ (-DROTH+SIN(THETA)-#+COS(THETA))	GE:		97 98			OTOPH(24,41), ACT(41) ,DTD2(24,41),DTDR(41) , ACT(41) , CONST(50) , GAM(20) , CONST(50) ,MREGOM , PS(41) ,	PYARS	•
	15	CONTENSE	GE	(1H	99			" "Screll , KSPHICALL, RSTCALL , RSTCALL, RSPHETCALL	PVARP	10
		MMAX.n.j	6E:		100			* JENO . PT . AIPHA . GANNA . STONA . YMACH . TARES .	SVARA SVARA	3
	C		GE	DM 1	102			TAPEZ - DISK1 - ALPH - DISK2 - STOM - HPRNT - DZOT - DZDPH - ZM - TMWD - TMLD - TMW - TML - TTMW -	SVARR	4
	Ç	GROOT SHAPE TABLE SUPPLIED BY USER	GE1		03			* TTML , RZ , BZ , NIPHI , NTT , KOUT , NITED .	SVARR	6
	Ž	CONTENUE	CE	개 1	05			NPHI , NPHI1 , NPHI2 , NPHI3 , NPHH1 , NPHH2 , NPHH3 , NT , NT1 , NT2 , NT3 , PHIFD , NCOME , RADI ,	SVARR	?
		J=1 hx2=c ah	GE1		06			* PHIF - METHODALLG - MRC - DIME - DUCTM - UTME -	SVARR	•
		nez=3.7	681 681		0.0			OTHF, GASCON, NPEAL, NPUNCH TPRNT-[CONST(4)	CECAT ZAY64	10
		NACOM-NRCC-1 DG 25 T-1,NRCCM	GE (		.99 .16			TF(K5.F0.2) GO TO 12	GE 041	ė
		nx1=nx2	GE!		11		12	CALL GEOMSTI, PHIP, MPHI, Z, PB, RSZ, RSPH, IPRNT) CONTINUE	GEDM1 GEDM1	10
		NR1=NR2 NX2=XX{[+1}-XX{[}}	SEC	и i	13			CALL GEOM2(K5) ON 1 J=3,NT2	GED#1	11
		782-YY(T+13-YY(T)	651 560		.14 .15			Y=XI(J)	GEOM1 GEOM1	12 13
		TF (XX(T) -GT-9-0) GD TO 29 75TA(3) XX(T)	GET	14 1:	16 .			DU 5 K=5*H5H[]	GEDM1	14
		97(3)=44(1)	650		17			4PR7(K)-T+(8987(K)-897(K))	68941 68841	15 16
		Pl=Soff(nel+pg1+px1+px1) P2=Soff(nel+pg2+px2+px2)	GE	м ї	19			% == ## P	GEDM1	17
		D*D*( J) == ( nel *n2/nx1+DR2+D1/Dx2)/(D1+D2)	95 95		20 21			D==(*DA7(K)-#87(K))	CEOMI	18
	25	Injet Continge	640	P 1	22			S==(RDRPH(K)=RBPH(K)) DTD7(J,K)=A/C	680M1	20 21
		75TA(J)=-YX(NBMN) -7(J)=YY(NBMN)	GE C		23 24			PTDPH(J,K)=B/C DTDR(K)=1.0/C	GEOM1	22
		PROJECT)=-(DR2+(2-C+DZ+DI)/DX2-DR1+D2/DX1)/(D1+D2)	6E 0	M 2:	25			ACT(K)=D/C	6E0#1	23 24
		MAXe.J Return	GE C		26 27			ACT(K)=EFC R=CeT+R=(K)	GED41	25
		CONTINUE	6 E F	<b>m</b> 1:	2 0 2 0			X=P+STN(PHT)	GENM1 GENM1	26 27
		75TA(11+0-5 R7(1)-R90	660	m is	36		,	Y==R+COS(PHI) CONTINUE	GEOMI	28
		THFTA1=THETA	GE 9		31 32		ī	CONTINUE	6E041 6E041	79 30
		A1=F3(F1,4) PPDZ(11=FZ(F1,1-G>)-6-A11/F9,	650	4 1	33			e Etile M	GE041 GE041	31
		1°Z	66 0 66 0		34 35				66041	32
		THANHIOTHAN-1 TO 50 TeleIMANHI	6E0	m 1:	36					
		AS=CINITHETA) AC=COS(THETA)	6£0		37 38					
	C	PREDICTOR	650	<b>- 1</b> :	39			SUPPOUTINE GEOMETRES	6EOM2	2
		A] = F3 (R] = H) K#O	6E0	4 1	40 41			COMMON /IDVARBIRK, ETA(41), PHIP(41), DTTL(41), DTTLE(41), DETA, TP(24) LEVEL Zo, PHO. P. U. V. N. ROP. ROP. ROY. VINF, WINF, RORPH, PR, PB7, RBPH, DTDPH,	INVARR	2
		7RY=F2(01,45,4C,41)	6E9		42 43			* RCT+DTD7+DTDR+ACT+ICDMST+GAM+CDMST+NREGDM+RS+RS7+RSP4T+RST+RS7T+	PVARS	2
		TE (DRY-LT-0-0) DRY=2.*H*AS*AC	650	4 10	44			FORMON /PVARS/ PHOC24.411. PC24.411. HEZ4.411. MEZ4.411. MEZA.411.	PVARS	4
		THE TA . THETA . OCL TAT	650 650		45 46				PVARR	6
		ASI=SEN(THETA) ACI=COS(THETA)	GEO	<b>4</b> 14	47			* RORPH(41) , R9(41) , 077(41) , RB+H(41) , TDPH(24,41) , BCT(41) , DTDY(24,41), DTDR(41) , ACT(41) , TCHEST(AT)	PYARB	7
	۲	· · · · · · · · · · · · · · · · · · ·	650 650		49				PYARR	ë
		Allerster;	CEN CEN	4 15	50			CUMMUNIZANBILIS DAL DI DI DI SINI	PVAR9 SVAR9	1¢ 2
		DPXX=F2(R,AS1,AC1,A11)	650	• i	71 52			* TEND , PI , ALPHA , GAMMA , SIGMA , MACH , TAPEL , TAPEZ , DISK1 , ALPH , DISK2 , SIGM , NPRHT , DIDT ,	SVARA	3
		TF fORXX-LT-0-01 DRXX=2-0H04S10AC1 *LOPE=1-50(DRX0DRXX)	6E0	4 <u>1</u> 9	53 54			T DOPH > ZM  > TWO > THLD > THW > THL	SYARR	•
		R=P1+SLTPE+DELTAT	660	4 is	55			TIML . RZ SZ . MIPHI . MIT . RPMI . MITER .  MPMI . MPMII . MPMIZ . MPMIZ . MPMMI . MPMMZ . MPMMI .	SVARR	6
		IF (KeLT-5) 60 TO 45	6£0					T NTL ANTE ANTE ANTE ANTE AND ACONE AND A	SATES	7
		75TA(J)==90AC1 #2(J)=90AS1	640	;	50			PHTF , METHOD, LAG , NBC , PINF , RHOTH , UINF ,	SVARS	10
		DP07(J)=(#04C1+4\$105LOPE)/(R0451-4C1+5LOPE)	6E9		59 60			DO 1 K=1,NPHI2	GEOMS	6
		J-1+1	650	4 16	61			60 TO (3,2),K3	GE DH2	7
	90	CUNTINUE	6E0			;	2	CONTINUE ROR(K)=RS(K)	6E045	9
		MMAX-J-1 RETURM	660 660	1 10	64			9052(K)=RSZ(K)	GEOM2 GEOM2	10 11
		₹ND	650					PORPHEK)=#SPHIEK) GO TO 4	SP039	12
							3	CONTINUE ROBERSTEES	6€ O™2	14
								PORT(K)=RSZT(K)	GEOM2 GEOM2	15
								*OBPH(K)=RSPHIT(K)	6E D#2	iŦ

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				1		
4 1	CONTENUE	GEDMZ	18 19	* TAPEZ , DISK1 , ALPH , DISK2 , SIGM , NPPMT , DIDT ,	SYARR	4
1	CONTINIE PETURN	GED#2	1 9 20	<ul> <li>DZDPH » ZM » TMWD » TMLD » TML » TTHW »</li> </ul>	SVARS	5
	END	GEOMZ	21	<ul> <li>TTML , RZ , BZ , NIPMI , NIT , KPMI , NITER ,</li> <li>NPMI , NPMII , NPMI2 , NPMI3 , NPMMI , NPMM2 , NPMM3 ,</li> </ul>	SVAPR	6
				* NT , NT1 , NT2 , NT3 , PHIFT , NCONE , RATE ,	SVARR	Ř
				<ul> <li>PHTF , METHOD, LAG , NBC , PINF , RMDIN , HINF ,</li> <li>PGINF, GASCOM, MREAL, MPUNCH</li> </ul>	SVARR	
				COMMON /TRANSF/ AMACH, GAMF, MMZ, PILMF, RILMF, PULL PROCESO, 31,	TRANSF	10
	SURROUTINE GERMS (K7, PHIP, NPHI, Z, RB, RB7, RRPH, IPRNI)	GE DM 3	2	* R4090(26,31,U90(23,31,V96(28,31,W96(26,31,R590(31,	TRANSF Transf	3
	COMMON/JOE/2Ll,CF1,CF2,7LF.TTRAN.D7TRAN	JOE	ź	<ul> <li>PS790(3), RSPH90(3), HRO, R90, XINIT</li> <li>RADI=57, 29578</li> </ul>	TRANSF	10
	COMMON /TPANSE/ AMACH, GAME, KMZ, PLINE, PLINE, VLINE, PQC (20,3),	TRANSF	Ž	PT=3-14159265	INITA	11
	<ul> <li>RHN90(20,3),U90(20,3),V90(20,3),W90(20,3),RS90(3),</li> <li>PSZ90(3),RSPH90(3),HRD,R90,X[N]T</li> </ul>	TPANSF TPANSF	3	7[NT=Y]M[T 7=7]MT	INITA	12 13
	LEVEL 2, PS.RBPH.RS7	GE CH3	5	TEND-7LF	THETA	14
	OTMENSTON RA(411, RBPH(41), PRZ(41), PH(P(41) OTMENSTON ZSTAC200), DRD7(200), PZ(200)	GEOM3 GEOM3	6	ALPHA=J+O 41PHI+7	INITA	15 16
Ç		GE THIS	ė	45T=×42	INTTA	17
Ç	•• CONSTANTS	6E0#3	10	YM≜CH∍âM≜CH Gâmma≡Gâmp	INITA	16
•	TF(KToNEoL) ON TO 1	65043	11	ALPHALPHA/RADI	INSTA	5¢
	CF2=1.7 AMG=99.5	CÉDH3	12	SIGMOSICMA/RADI	TNITA	21
	MST-1	6E043	13 14	P4IF=18(+1/PADI 4P4I=NIPHI+3	INITA	2? 23
	H=HRT	GE043	15	NPMI1=NPHI+1	INITA	24
	RMOSE-1. CALL GERMIRNOSE,AMG,RZ,DRDZ,ZSTA,H,R90,MMAY)	6E 0#3	16 17	NPUT2 = NPUT42 NPUT2 = NPUT41	ATTHI	25 26
	MMYX1=MMYX-I	ĠĔŃ43	1.4	NPHM2 = 4PH1 - 2	IMITA	*7
r	• ETU•4	GEN43	1 9 21	NT=NT+2 NT1=NT+1	IMITA	2 R
Č	FING CORRECT Z INTERVAL	GERMS	21	412=HT+2	INITA	2 9 3 0
c,	CONTINUE	6EU#3	22	TCNNST(1)=1	INTTA	31
	Newst	668#3	22	TCONST(10)=1 TPPNT=ICONST(4)	THTTA	3? 33
	TE (7.LT.75TAINSTI) GO TO 22	GE DM3	7.4 25	IF (ICONST(48).NE.1) ICONST(5)=0	INTTA	34
	00 18 N-NST-NMAY1 TF (7-LT-7STA(N+1)) GO TO 20	GE 1143	26 27	LAG=1 neta=p4t=/flnat(ntpmt)	ATIMI ATTMI	35 36
19	CONTINUE	GEOM3	29	DPHT=DETA	INTTA	37
20	N-NMAY]	66.043 66.043	?0	TT=1.7/FLGAT(NT=1)	INSTA	36
	usten	66043	30	7707770T 77074077/75T4	INTTA In Ita	3 Q 4 P
22	CONTINUE	GECM3	32	GAM(1)=(GAMMA-1.01@C.5	INSTA	41
	PBODY=PZ(N)+(PZ(N+1)-RZ(N+)/{ZSTA(N+1)-ZSTA(N+)+(7-7STA(N+) RRODY7-DRD7(N)+{DRDZEN+1}-DRDZ(N)}/{ZSTA(N+1)-TSTA(N)}+(7-7STA(N))	6E043	3 7 3 4	GAM(2)=GAM(1)/GAMMÁ CMERTOTOMAL CLUSTERING	THTTA	42 43
	RSTDP4=0+0	€Eum3	35	ONINUTE CONTRACTOR	INTTA	
	10 30 K=3;4PHI RR(K)=PRONY	GEDM3	36 37	®K=0.1	THITA	44
	PRPH(K)=R405PH	GECM3	3 P	PJ=0.7 TF(0K.E0.5.9) 69 T3 15	THITA INTTA	46
	RR7{K}=PRINYY CONTINUS	GECM3 GEOM3	3 9 4 0	Y3=0.5/RK+ALOG({1.3+(EYP(RK)-1.0)*P4TF7/1#C.0)/	THTTA	48
7.0	00 36 K=1,2	GED43	41	* (1.0-(1.u-EXP(-RK))*P41FD/183.0)) *C1-514H(0K0Y0)	THTTA Intta	4.9 50
	Mafiet	GER43	42	Y62=Y01/(RK+PHSFD/RADS)	INTTA	51
	F=NPHT+K N=NPHT-K	6 E D 4 3	43	15 CONTINIE DO 35 TI=2,NPHII	INTTA INTTA	52 53
	PR(K)=RR(M)	GE DM3	4.5	71=11-3 674(77)=27*N674	INTTA	54 55
	R#(T)=PR(W) PRT(K)=PRT(M)	6E043	46		INTTA	
	PAZ(T)=PAZ(N)	65043	47	TFIRK-GT-0-01 GO TO 43 PHIP(II)=FTAIII)	INTTA INTTA	96 97
	PRPH(K)==04PH(H) RRPH(T)==4RPH(H)	GEUM3 GEUM3	5°	?TIL(IT)=1.0	THITA	5.9
36	CUNTINUE	CED43	51	ntile(it) •0•¢ 60 to 35	INTTA	59 50
	RETURN	GEOM3	57	4U CONTINUE	IMITA	41
	END	GE DM3	53	YC3=RK+(ETA([[]/P[-YC) SHETA+S[NH(YJ3]	[N]TA [N]TA	53 63
				CHETA-COSH(Y33)	INITA	64
				PHTP(TT)=PHTFD/RADT+(1.0+SHETA/Y01)	THITA	
				NTIL(II)=Y)Z*PI/CHETA NTILE(II)=-Y0Z*RK*SHETA/CHETA**Z	THITA	66 67
	ATINI SHITUTRHUP	INTTA	2	35 CONTINUE	INITA	68
	COMMON/CLUS TR/RJ.X1(24),TX1(24),TX1T(24)	CLUSTR	2 2	P4TP{2}=-P4TP{4} P4TP{NP4T1}=-P4TP{NP4M1}	INITA	69 70
	COMMON/ENTRO/S(41), ZBS, ZFLD, TTPRTB, TTPRTF, MCASE, MTDSOS COMMON /TDYARB/RK, ETA(41), PMIP(41), DTIL(41), DTILE(41), DETA, TP(24)	IDVARS	ź	ntit(2)=011L(4)	İNİTA	71
	COMMON/JOE/7L1,CF1,CF2,ZLF,ZTRAN,DZTRAN	ane.	?	<u> </u>	INITA	72 73
	LEVEL 2, RHO, P, U, V, W, ROB, ROBZ, VINF, WTNF, RORPH, RB, RB7, FBPH, DTDPH, - RCT, DTDZ, DTDR, ACT, ICONST, GAM, CONST, MREGOM, RS, RSZ, PSPHI, RST, PST, PST,	PYARR	3	OTILE(NPHIL)==OTILE(NPHHL)	THITA	74
	• RSP4TT :	PV AR B	•	0T1LF(31=0.C	THETA	75
	- COMMON /PVARB/ BHG(24,41), P(24,41), U(24,41), V(24,41), V(24,41),	PYARR	5	DTILF(NPMT)==== C== RADIAL CLUSTERING	INITA Inita	76 77
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2. 1•	no 16 N=1,4  4(N)=4(N)  f(N)=4(N)  f(N)=6(N)=71(f(X)  f(N)=6(N)=71(f(X)  f(N)=6(N)=71(f(X)  f(N)=7)  f(N)=70(N)  f	toron Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon Tocon	73 74 75 76 77 77 77 77 82 83 84 85 86 87 91	FACT=0, T = YMACH = YMACH = (GAMMA-1.0)  FACD=(FACT=1,6) = 0 + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) + (1.0) +	מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מעדפדת מ	113456799212222222222222222222222222222222222
	CO TO 35	11014	92	WRITE(9) J, Y, VX(JZ, KZ), VY(JZ, KZ), RHJF(JZ, KZ) ZJ CONTINIE	アナマナいり ロリアアドル	30 31
36	cTE#P(Y, J, Y)=E(H)	EGCON	94	9E719N	NUTPT4 NUTPT4	32 33
3.5	CONTINUE FORN, JyK3 = F(N)	TOCON TOCON	95	6,), FORMAT(SX,[3,3(10Y,F10.4])	DUTPTH	34 35
	GO(N, J, M)=G(N) Hr (N, J, M)=H(N)	TOCON	97 98		Gilletin	••
9	CONTINUE	TOCON TOCON	100			
	PETIJON	EDCON	101			
, ,	CONTINUE CONSERVATIVE VARIANCESPERFECT GAS.	TOCON TOCON	132		PHTUPH PHTUPH	2
	\$4=1,0=G4m{21 nn 1	IOCON IOCON	174	YMUEMS = ATANESORTECHEMON-1.133/SORTE-ATANESORTEMON-1.33	PHTIPH	3
	nn 3 Ja3, nt. Ameremp(1, J. K)	TOCON	106	CHeCA WA	PMTURN PMTURN	5
	4.ETE**12,1,K1	TOCON	138	5971 - 597(6)	PHTICH PHTICH	7
	U=ELc=0(3*3*K)	IOCON TOCON	110		PHTURN	10
	**==*/ <u>\$</u> V{j,*}=*/ <u>\$</u>	TOCON TOCON	111	ทยเลื = สทีเรื จอีทีม	PHTIJRN	11
	CO-CAMESIACTOR ACCIONIS +45-ACCIANS +453	TOCON	113	7P 10 f=1,20	PHT'JRY Pytien	12 13
	ግባ«፡፡ዓ ቀቀ2ፋ  ፲ ቀል <u>ል</u> ቀር ሮ	TOCON	115		PH TUPH PH TUPH	14 15
7	TEINA) 7,8,5 COMPENIE	19694 19694	116 117	TE (M?GT. 149.0) ON TO 20	PHTURN	16
•	CONTINUE Pre(+)	TOCON TOCON	110	, the east	PHTUPH	17
	**(1,**)=(-99+508T(93))/(2+(+4A) ####################################	THENN THENN	120	#2 = 100e)	P47194 P47194	5 L
	*{J,K}*PP4N{J,K}*{L,o'U{J,K}*C,J,K}**Z-Y{J,K}**Z-Y{J,K}	TOCAN	127	V917F(6,1) 33 CMY!NUF	PATISA PATISA	?1
•	CONTINIC	TOCON TOCON	123		PHTHM	2.2
	CNO .	Inch	175	1 FORMATCIEY, 47H RODY TURN STORMEN AT 42 - 100.03	patijen Patijen Patijen	24 25 26
	CUMBOUITINE CRITCIN TRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTRICSOLUTR	DITPT4 CLUTTR DRTTP4	2	eijaboisti hr. Shijckhilka)	540CK#	ę
	COMMON INVSTRMY PPLOTONZENDONZENDON NEPLOT	TOVARA	2	LEVEL ZyCTEMPyEDyFBygGoyMi	CVARR	2
	LEVEL 2, 040,P,IJ,V,W,ROR,BORT,VINE,WINE,BORT4,RR,RR,RRPH,OTOPH,  RET,OTDT,DTOR,ACT,ICONST,GAM,CONST,NPEGON,RS,RSZ,RSZHI,PST,RSYT,	5476d	?	* F({4,24,411 , GO(4,24,411 , 40(4,24,411	CVARS	4 2
	. Gunum langual sudiseless, biseless, hiseless, aiseless, aiseless, aiseless,	4 A 7 4 d	4	LEVEL 2, PHO, P,U, V, W, ROA, PORT, VINE, WINE, ROPPH, RS, PB7, ABPH, NTOPH,	PVARS	ž
	• POR(41) , POB7(41) , VINE(41) , VINE(41) , POB7(41) , PR(41) , P	PVAPA	6		PVARR	3
	n ntn=4(24,41), ect(41) ,ntn2(24,41),ntn8(41) , #cf(4*) ,		į		PV488	5 t
	• TCOMST(50) • GAM(20) • CONST(50) • NREGON • RE(42) • PS7(41) • PSPMT(41) • RST(41) • RS7T(41) • PSPMT(41)	PYARR	10	· RORPHIGES , PRIGES - PRICES - GRANICALS -		Ť
	COMMON /SHOCKS/ DRSDX(103)+ DST(53) COMMON/SHARATEZ - PHI + DT + DZ + DPHI + ZTHY +	SATES	2		PYARR	ē
	a rend , pr , alpha , gamma , stoma , xmach , tapel ,	SVARA	3	COMMON/SVARE/T,Z , PHI , DT , TT , DOME , ZINT ,	SYARR	10
	TAPEZ , DISK1 , ALPH , DISK2 , SIG4 , WORNT , D7DT , D2DPH , 7M , TMMD , TMLD , TMW , TML , TTMW ,	SVARR	•	<ul> <li>TEND , PT , ALPMA , GAMMA , STGMA , KMBCH , TAPE1 ,</li> </ul>	5 V 4 P R	3
	<ul> <li>TTML , RZ , PZ , NIPHI , NIT , KPHI , NITER ,</li> <li>HPHI , NPHT2 , NPHI2 , NPHI3 , MPHM2 , NPHM3 ,</li> </ul>	SVARR	7	WHIT , IMI , UHI , OUPT , MY , MCC70	SVAPA	•
	A NT , HT1 , HT2 , HT3 , PHTFT , NCONE , RATT , PHTF , HETHOD, LAG , NSC , PTMF , RHOTN , UIMF ,	SVARR	Ę	જ પ્રક્રેયા કે સક્ષ્માર કે સફ્રમાર	SVARR Svarr	7
	+2INF.GASCON.NBEAL.NPUNCH	SVARR	10	<ul> <li>MT + NT1 + NT2 + NT3 + PHIFT + NCONF + RADT +</li> </ul>	SVARR	ć
	COMMON /FLOW/ RCT20,1003, YCC2G, 1003, YFC20, 1003, RHOFC2C, 1L03 LEVEL 7, VX, VY	AC Ualle	2	OTHE, GASCOM, WREAL, MPUNCH Co. RANKINE-WIGONIOT FUNCTIONS	SVARR	10
c	COMMON/VCOMP/ VX120,1003,VY123,1063	VC DMP NUTPTM	11		440044	é

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	DRSDZ(A,8,C,D)=(UTMF=C+A=SQRT(D=(1,+B=9)+C+C))/D	SHOCKH	10	USF-US(UIMF,ABART,RSZI) (1	HOCKE	••
	AMAR(A, M, D, E, F)=(F-1, 1+ASS(-UINF+D+A-R+E)/((D+D+1,+E+E)+F) US(A,B+C1+A-C+B	SHOCKN	11	43F+43(41MF(K1)ABART) 31	HOCKR	94
	VS(4, 8) = A+3	340CKH 340CKH	12		HOCKR	*5
	W\$ (4, 9, C) = 4 = 8 = C	SHOCKH	13 14	*HOCHT?+K1=ROSF	HOCKH	97
	GAMPI=GAMMA=1.	SHOCKH	15		HOCKM HOCKM	"
	GRATIO-GAMM1/GAMP1	SHDCKN SHDCKN	16 17	VENT2,K)+WSF	40CK#	100
	GAMPIG-GAMPI/GAMMA Cl-0.5+GAMMI+PINF/RHOIN	SHOCKH	18	10 (01)1408	HOCKH	101
	CZ-0_50GAMP1G-0C1	540CK# 540CK#	19	Me6→K	HOCKH	192 103
	40 TO (1,2),K4	SHOCKH	20 21	I=NPHI+K 5	HECKH	104
Č., 54	CONTINUE  OCK PPEDICTOR	SHOCKH	22	## ###	HOCKM HOCKM	105 136
	TIT 3 K+3, NPHE	5400KH 5400KH	23 24	#57(T)=R52(N)	400K#	107
3.	PST(R)=PS(R)+DZ+RSY(R) NO 4 R=1,2	SHOCKH	25		HBCK4 HBCK4	108
	#96-K	540CK4 540CK4	26 27	11 CONTINUE	HOCKH	110
	I-NPMI-K	SHOCKM	2.0		40CKH	111
	PST(K)=RST(N)	540CK# 540CK#	29	1.00	40CK#	112
	PST(I)-RST(N)	SHOCKH	30 32			
•	OU 2 K-3 WARE	SHOCKM	32			
	RSPH[T(K)=(RST(K+1)-PST(K-1))/(2.D=DETA)+DT(L(K)	SHOCKH SHOCKH	33 34	FURROUTTHE		
	PS=P[MT2,K] PSRAT=PS/PTMF	SHOCKH	35		ETDAT Lustr	5
	U1T-HITTLD(PSRAT)	SHOCKM	36 37	LE VEL Z, ETE 40, E0, F), 60, HD	VARB	Ş
	RHPATHRHOS(PSRAT)	SHOCKH	3 6		VARA	3
	PSPH=RSPHTT(K1	240064	30	COMMON/ENTPO/S(41), ZBS, ZFLD, TTPRTB, TTPRTF, NCASE, NTDSOS	VARR HTRO	;
	ozama-mahitusi	540CKM 540CKM	40 43	COMMON /IDVARB/RK,&TA(41),PHIP(41),DTI(41),DTILE(41),DETA.TP(24) TI	DVARB	ž
	FACTI-VINF(K)-WIMF(K)-RSPHR	SHIPCKH	42		7484 JE	2
	FACTZ=UIMF+UIMF-UIT+UIT TFTFACTZ -LT. 0-)UIT=-UIT	SHOCKH	43	BCT+DTD7+DTDR+ACT+ICONST+GAM+CONST+MREGON+RS+RS7+RSPHT+RST7+PSZT+ PI	VARB	3
	PSZT1 =DPSDZ (U1TpRSPHR»FACT1,FACT2)	540CK4 543CK4	44	- M35411	VARS	4
	R\$7T(K) = P\$7T1	\$400KH	46	" "COB(41) , BOBZ(41) , VINF(41) , VINF(41) ,	YARB Yarb	6
	ARART-APARTYTHE (K), WINE (K), PSZTI, RSPHR, RHRAT) UST-USTUIME, ARART, RSZTI)	540CK# 540CK#	47	" "UTPH[41] » R4{41} . P47{41} . P804/411 . p4	VARR	7
	YST=YS(YINF(K),ABART)	SHOCKH	4.9	* ICONST(5C) , GAM(2D) , CONST(50) , NREGON , RT(41) . B)	VARS Vars	
	WST-WSTWINFIT), ARART, RSPHP) IF ENREAL. EQ. C) ROST-BHRATORHOIN	240CK# 240CK#	50 51	Applied by Azbelleth Balleth by Azaleth babelleth	YARB	10
	PHD(NTZ,K)=RGST	SHOCKH	52	COMMON/SYAPS/T,7 , PHI , DT , DZ , DPHI , ZINT , SI PEND , PI , ALPHA , GAMMA , SIGMA , XMACH , TAPE1 , SI	VARB VARB	2
	A(M15'K)=A21 n(M15'K)=A21	440CK4	53	ince a drawt a what a prake a state a maket a babt a ci	YAR 9	;
	WINT2,K1=WST	540CK# 540CK#	54 55		4463	5
5	CONTINUE	<b>SHOCKH</b>	56	* МРЧТ » МРЧТ » МРНІЗ » МРНІЗ » МРНИЗ » МРНИЗ » МРНИЗ » С	YARR Yarr	6
	77 6 K=1,2 4=6=K	5406KM	57 58	NT + HTE + NT2 + NT3 + PHEFD + NCOME + RADE + SI	VARS	ė
	T=NPHT+K	SHUCKH	59	*OIMF, GASCON, MREAL, MPUNCH	7495 7495	16
	M=MP4[=K PS7T(K)=RS7T(M)	5 H11CK# 5 H11CK#	60	Ší	ETDAT	10
	RSZT(I)-RSZT(N)	SHOCKH	61 62		EYNAT ETDAT	11
	RSPHTT(K)==RSPHTT(M)	SHICKH	63	iconst(1)=)	ETDAT	12 13
6	CONTINUE	\$496KH \$406KH	64		ETDAT	14
,	RETIMA CONSTAUR	\$40CKH	66	ICONST(4)=1	ETDAT ETDAT	15 16
Č54	OCK CORRECTOR	5400KM 5400KM	67		ETBAT	17
	PO 8 K=3,NPHI	SHOCKM	69	1 CONTINUE	ETDAT FTRAT	18
•	45(K)=R5(K)+G-5+(R57(K)+R577(K))+D7 DO 9 K=1+2	240CKM	70 71	NEC-1	ETDAT	19 20
	4=6 <b>-</b> K	SHOCKH	72	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	ETDAT ETDAT	21
	i = N PM f + K	SHOCKH	73	9711*0.0	ETDAT	2 Z
	#SEK1=RSEM1	540CKM 540CKM	74 75	2 Cincle and 2	ETDAT	24
•	TS(T)=PS(N) CONTINUE	SHOCKM	76	GAMET3=3.D	ETPAT ETDAT	25 26
•	00 10 K=3,NPHI	SHOCKH	77 79	a continue .	ETDAT	27
	959HI(K)=(R5(K+1)-R5(K-1))/(2.0+DETA)+DTIL(K)	<b>540CKH</b>	70	CONST(1)=0_c	ÉTDAT ETDAT	2 A
	PS*P(NT2,K) PSRAT=PS/PINF	5 40CK# 5 40CK#	96 91	9 CONTINUE	TDAT	30
	"IT-UITILD(PSRAT)	SHOCKH	82		ETDAT ETDAT	31
	#HRAT=#HOS(PSRAT) -#S2=PS(K)	\$40CK#	93	10 COMTINUE	ETDAT	32 33
	#SPM=RSPHI(K)	5 40CK# 5 40CK#	95	70 11 1=1-41	ETOAT	34
	REPHRARSPHIRS1	SHOCKH	86	R7P2(1)=0.0	ETPAT ETDAT	35 36
	FACT1=VINF4K3-WINF4K3-RSPHR FACT2=UINF+UINF-U1T+U1T	SHOCKA	A7 38	Alastis Of D	TACT	37
	TF(FACT2 alto 0.001to-01t RST1 -DRSDZ(ULT) RSPHR, FACT1, FACT2)	SHOCKM	99		ETPAT ETPAT	36 39
	425(K)+4251	540CKM 540CKM	, 90 91	K8(1)*D*C	ETOAT	40
	ARABT-ABAPEVENFERI, WINFERI, PSZI , RSPHR, RHRATI	SHOCKH	95		ETDAT	41
				·· ·· ·· · · · · · · · · · · · · · · ·	ETDAT	42

	RCT(1)=L=2 DTDR(1)=D=0 ACT(1)=B=0 RS(1)=B=0 RS(1)=D=0 RS(1)=D=0 RST(1)=D=0 RS	SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT SETDAT	43 44 45 46 47 40 90 91 92 93 94 95 95 96 97 98 99 90 90 90 90 90 90 90 90 90
	WfJ,T1=G,B	SETDAT	60 61
n	DTD2(J, E)=3.Q CONTINUE	SETDAT	54
	END	SETDAT	66

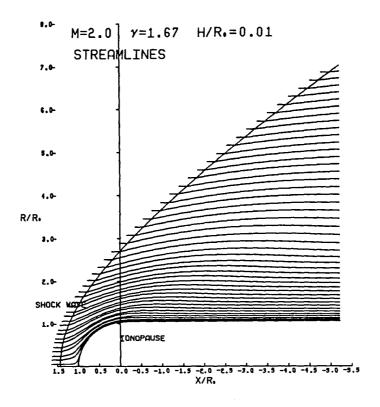
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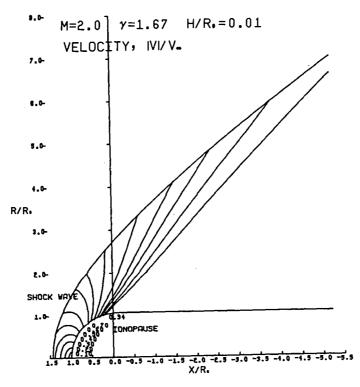
APPENDIX C

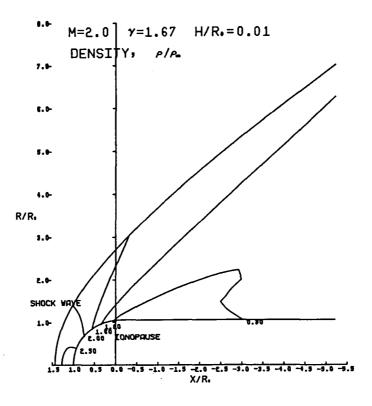
CATALOG OF TEST CASES

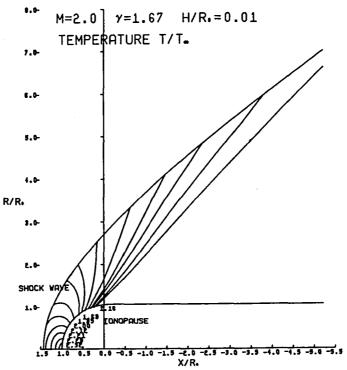
Catalog page number index for plasma streamline, velocity magnitude, density, temperature, and unit magnetic-field maps for various solar-wind flows past planetary ionopauses

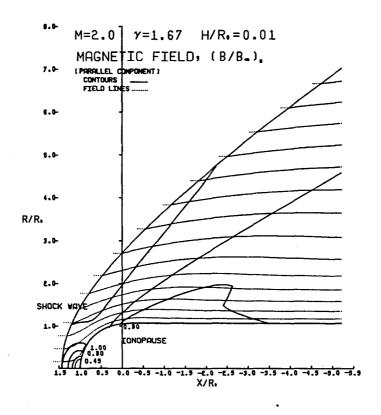
various solar wind flows past planetary lonopauses								
н/R _o	M _∞	Υ	(Page No.) Streamlines	(Page No.)  Velocity  magnitude   v /v	(Page No.) Density ρ/ρ _ω	(Page No.) Temperature $T/T_{\infty}$	(Page No.) Parallel magnetic field ( B /B _w ),	(Page No.)  Perpendicular  magnetic  field  ( B /B _w )
.10	2.0 3.0 5.0 8.0 12.0 25.0 3.0 5.0 8.0 12.0 25.0 3.0 5.0 8.0 12.0 25.0	5/3	179 182 185 188 191 194 197 200 203 206 209 212 215 218 221 224 227 230	179 182 185 188 191 194 197 200 203 206 209 212 215 218 221 224 227	180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228 231	180 183 186 189 192 195 198 201 204 207 210 213 216 219 222 225 228	181 184 187 190 193 196 199 202 205 208 211 214 217 220 223 226 229	181 184 187 190 193 196 199 202 205 208 211 214 217 220 223 226 229
H/R _o	M _∞	Υ	Streamlines	v /v_	p/p _∞	T/T _∞	( B /B _w ).	( B /B _w )_
.20	2.0 3.0 5.0 8.0 12.0 25.0 3.0 5.0 8.0 12.0 25.0 3.0 5.0 8.0	5/3	233 236 239 242 245 248 251 254 257 260 263 266 269 272 275 278 281	233 236 239 242 245 248 251 254 257 260 263 266 269 272 275 278 281	234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282	234 237 240 243 246 249 252 255 258 261 264 267 270 273 276 279 282 285	235 238 241 244 247 250 253 256 259 262 265 268 271 274 277 280 283 286	235 238 241 244 247 250 253 256 259 262 265 268 271 274 277 280 283 286

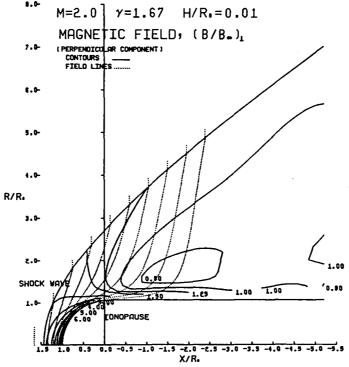


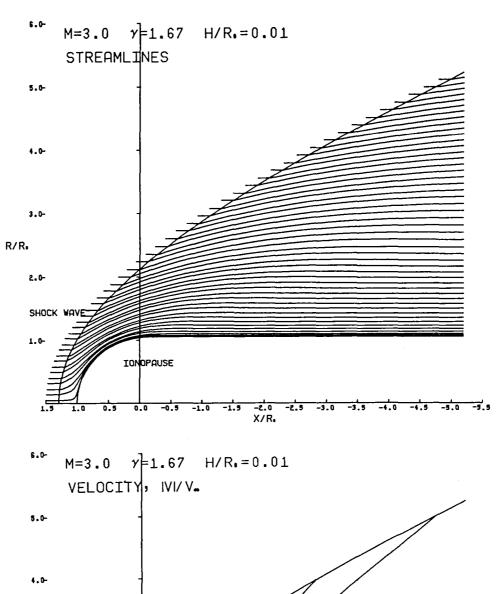


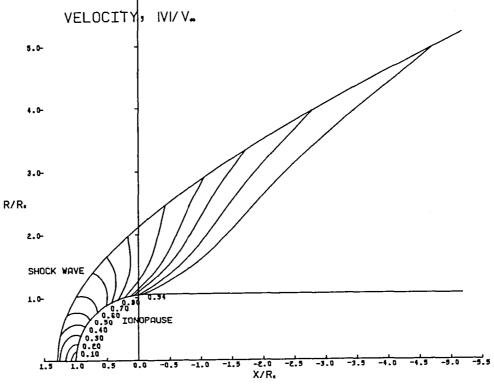


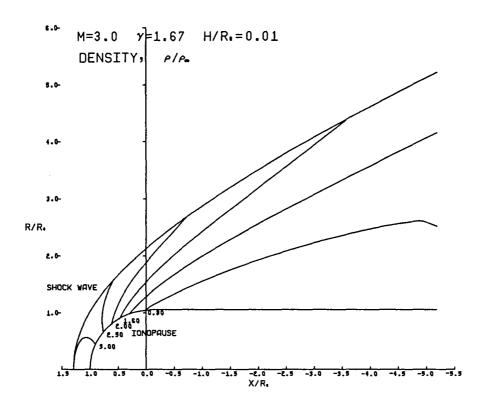


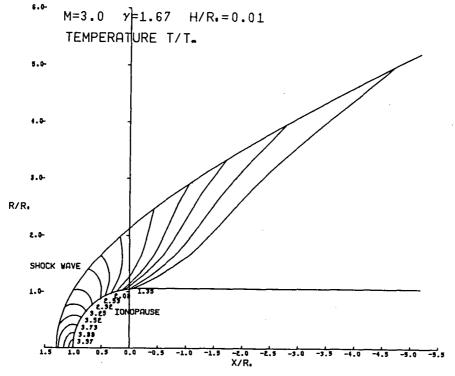


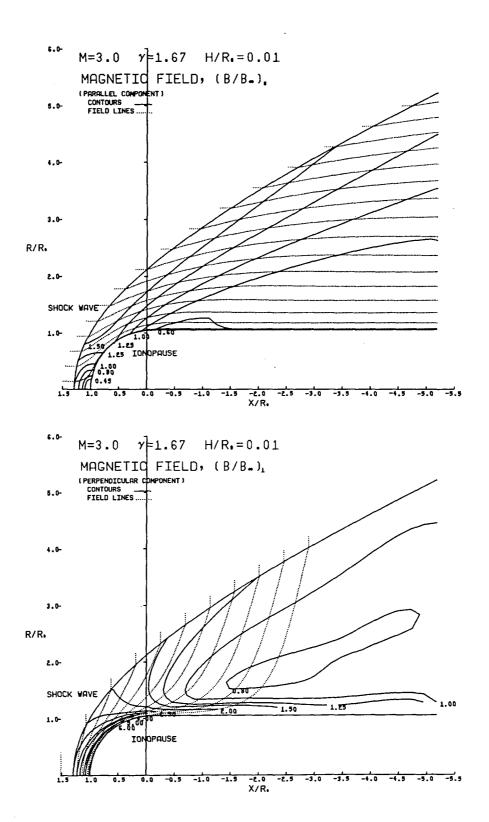


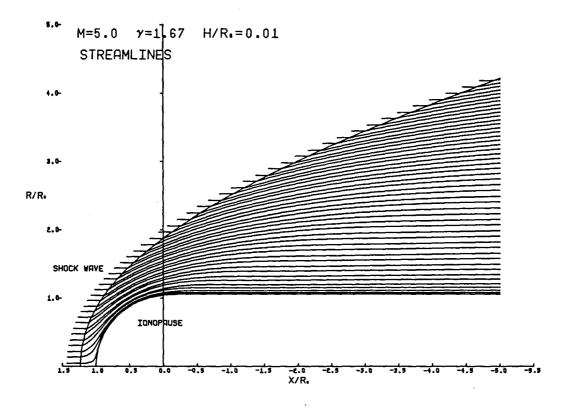


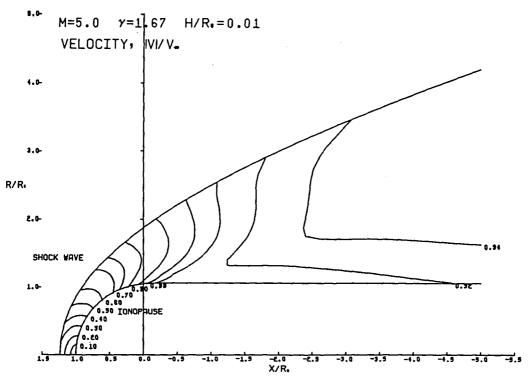


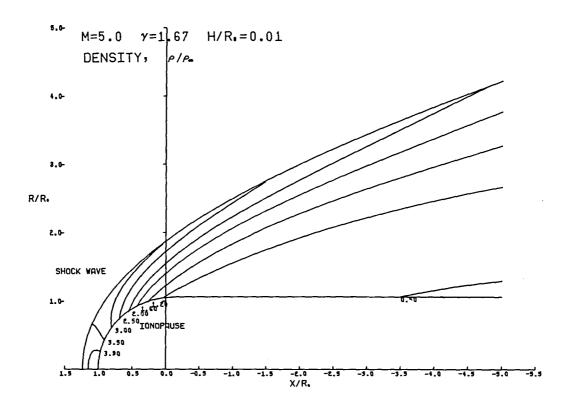


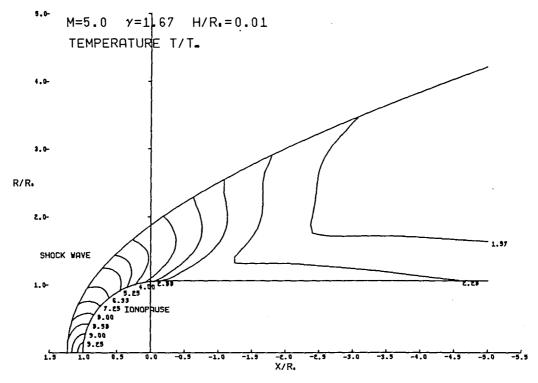


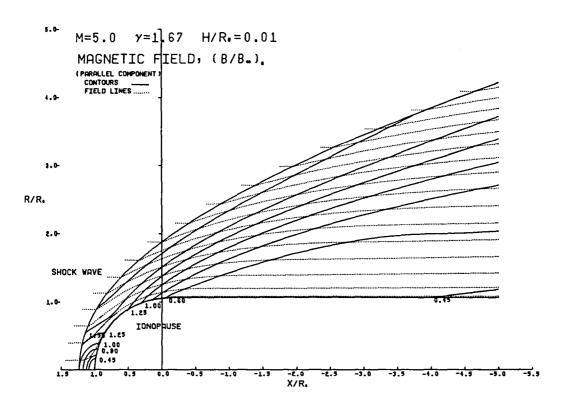


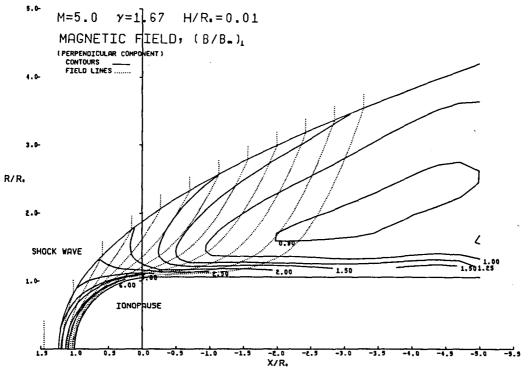


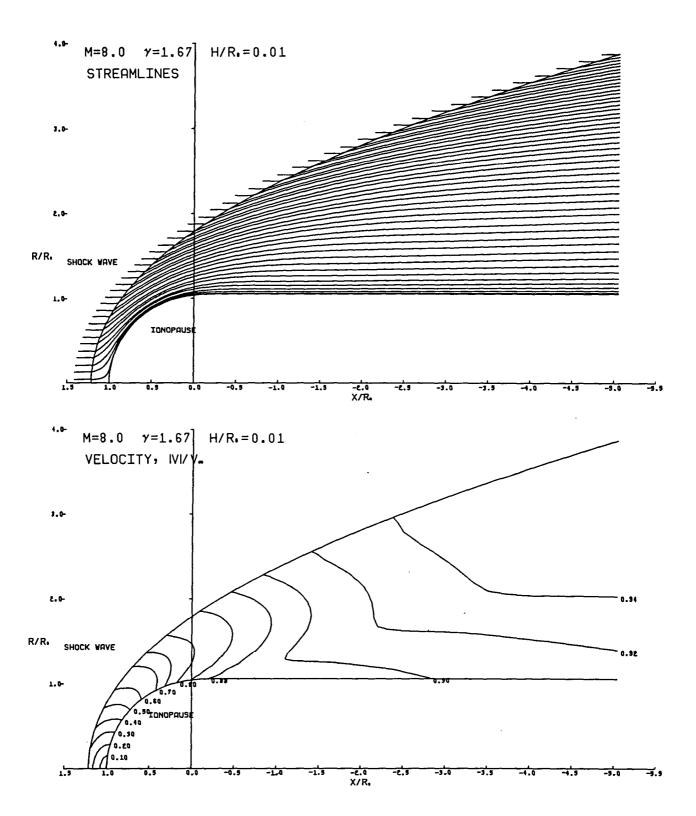


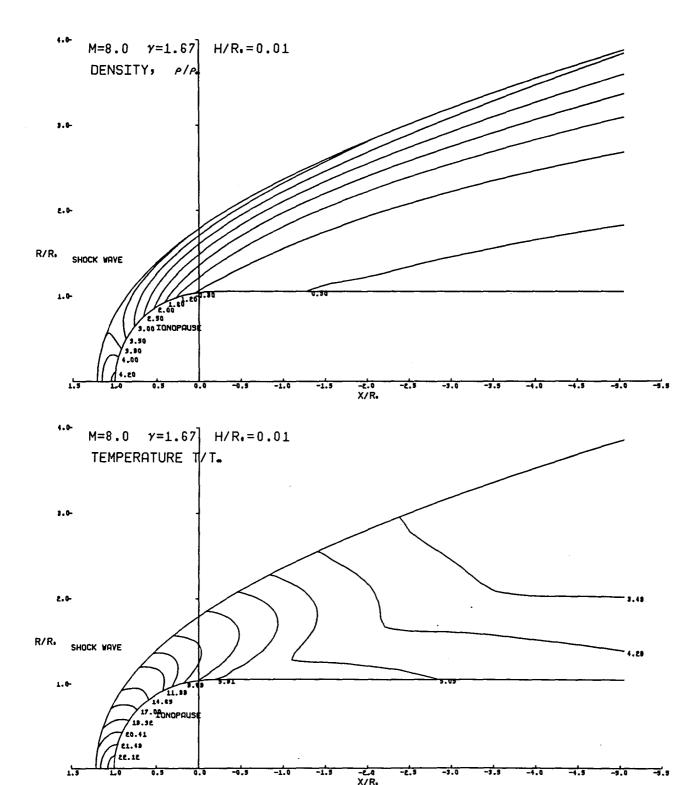


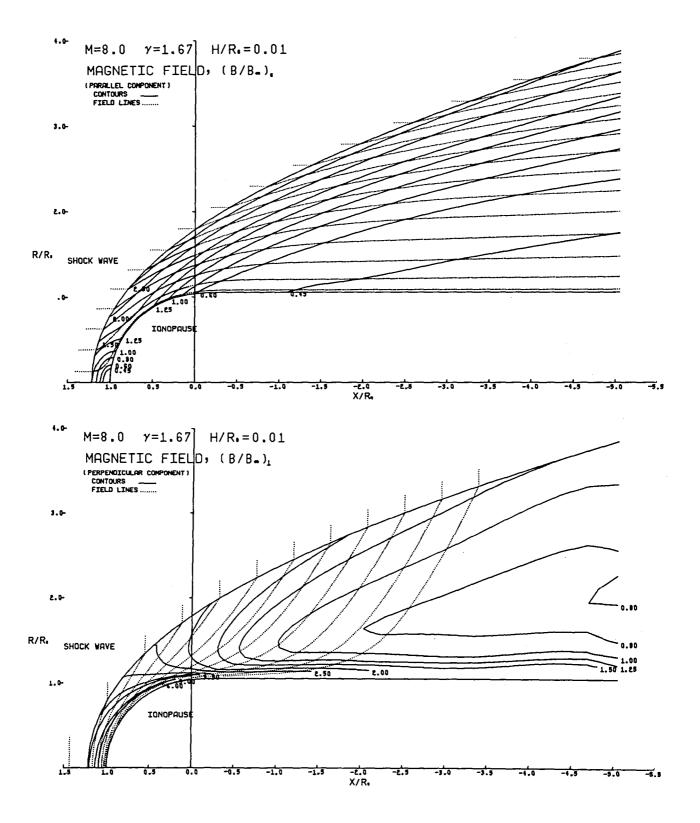


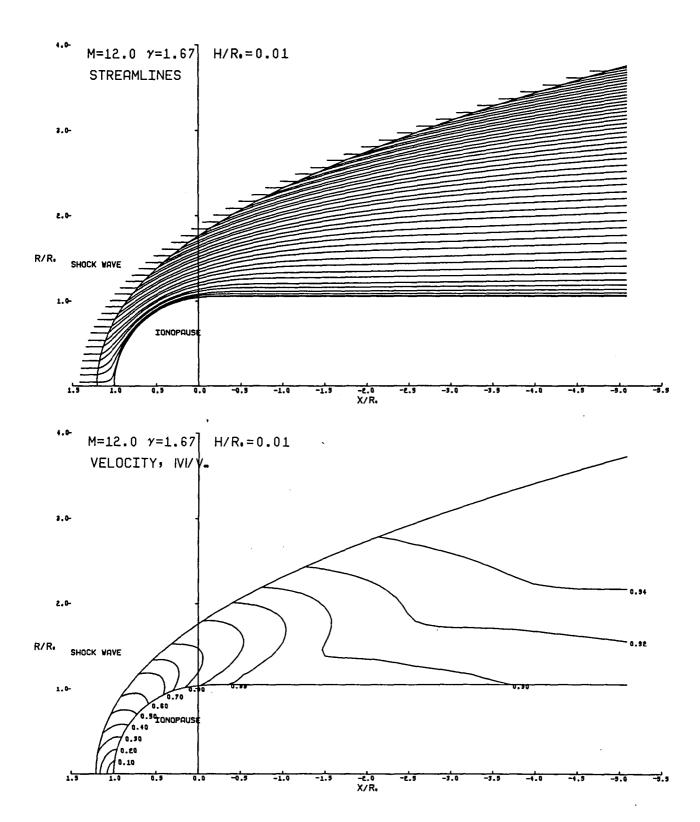


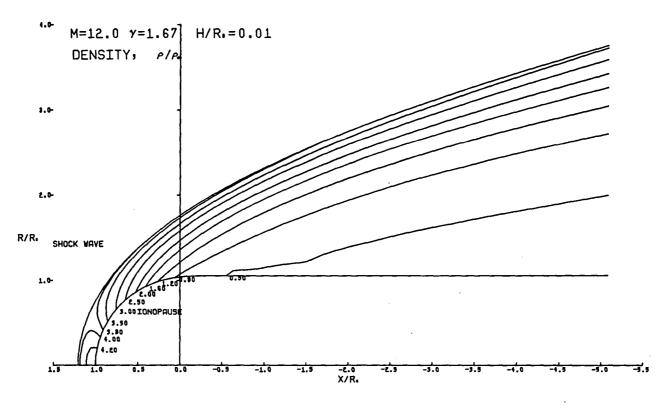


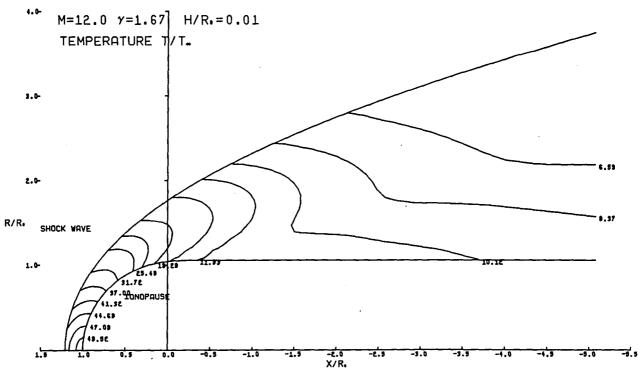


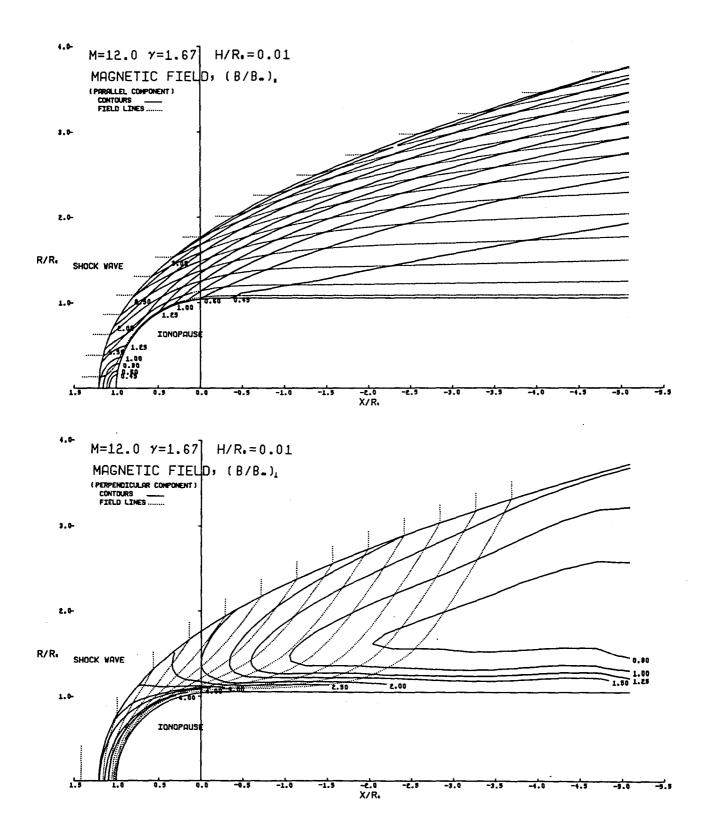


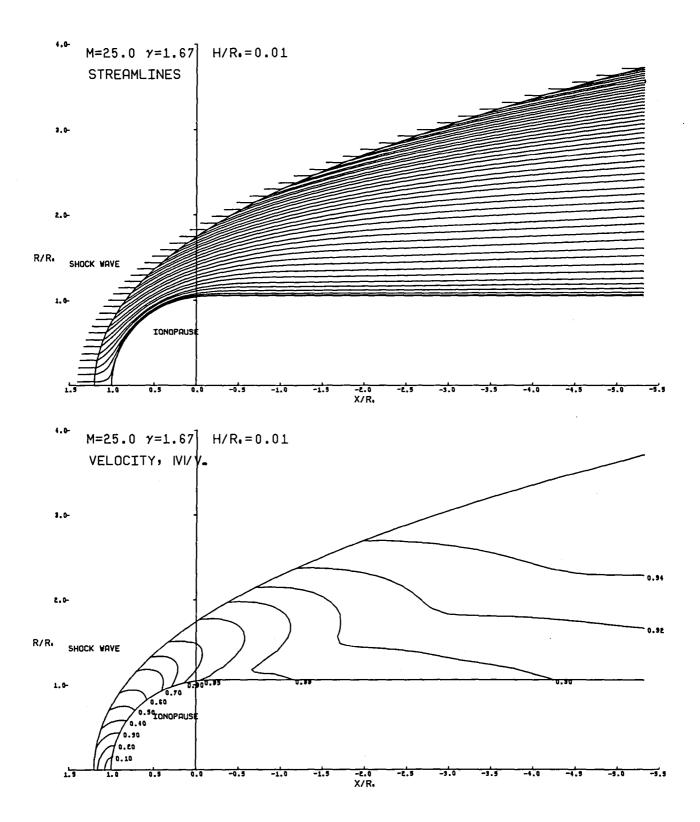


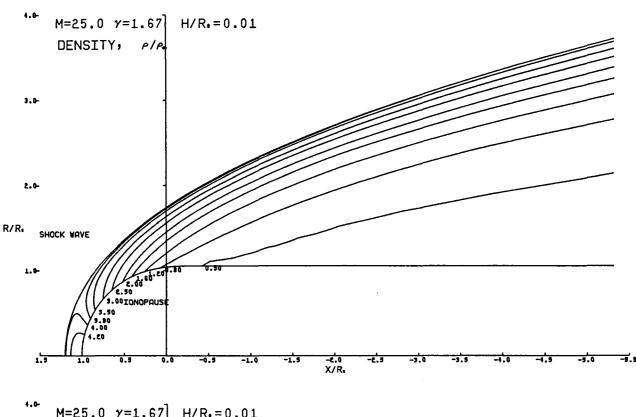


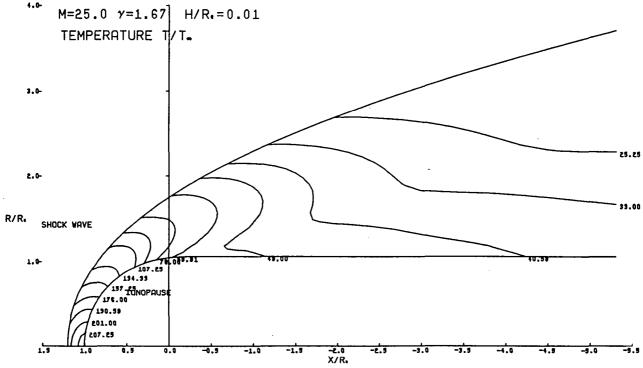


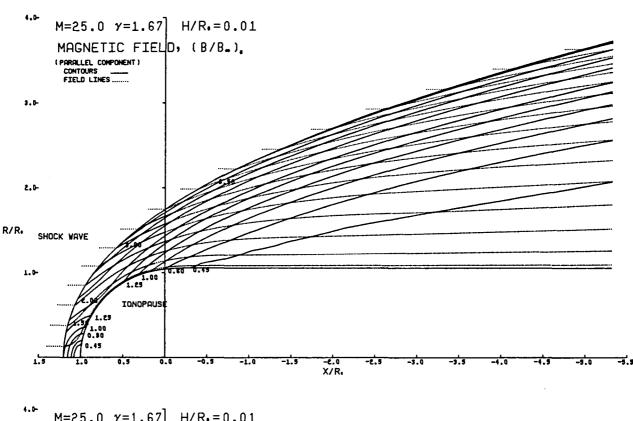


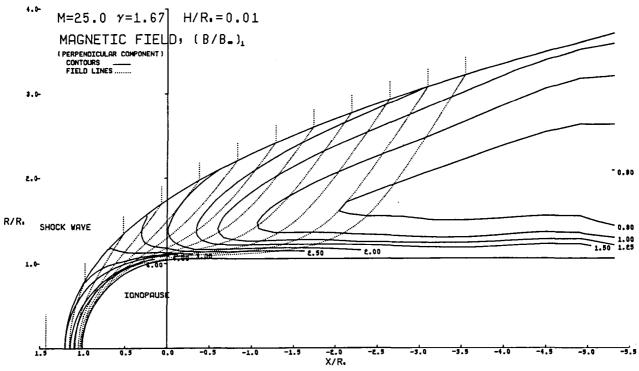


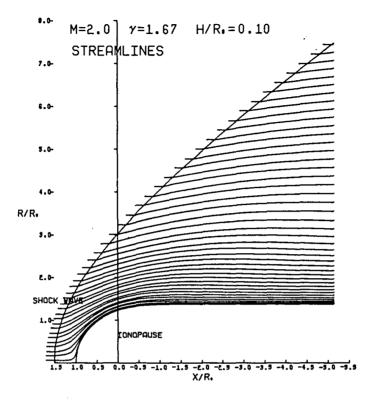


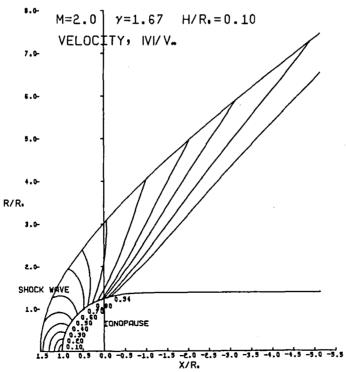


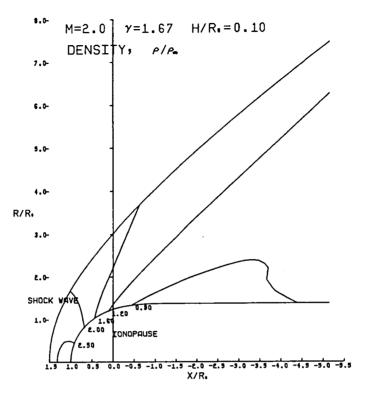


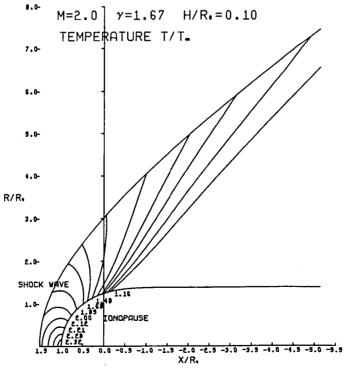


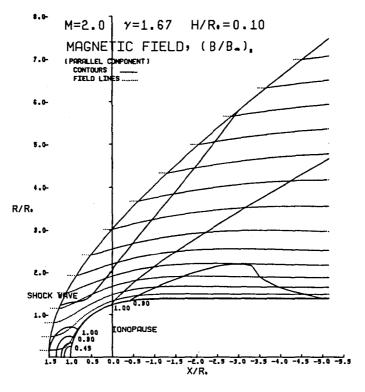


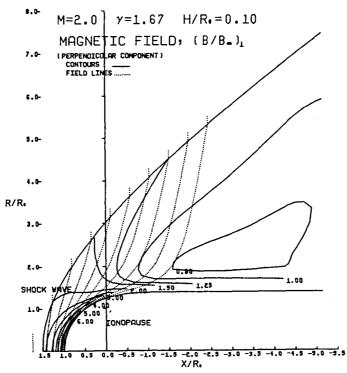


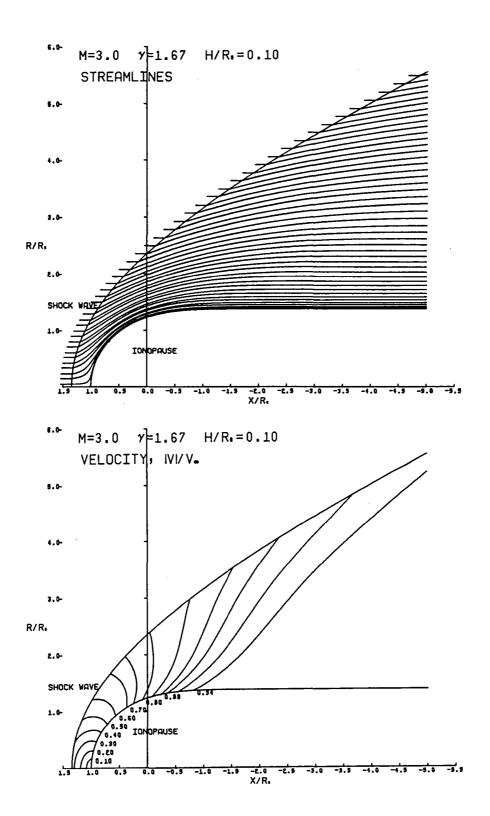


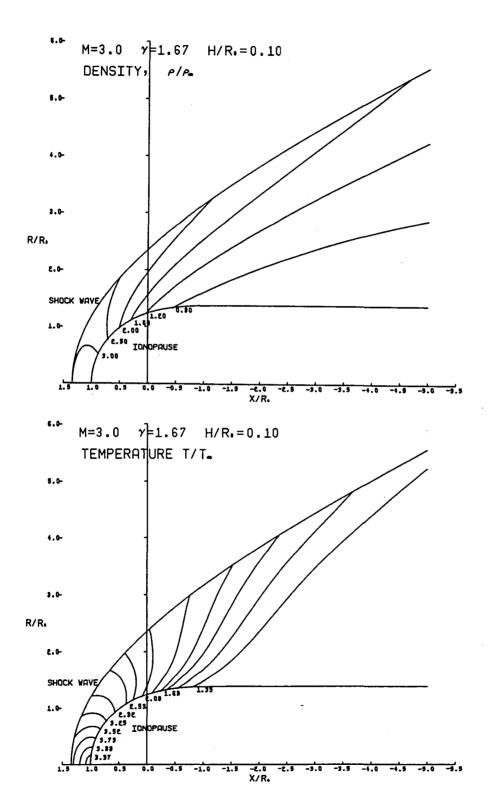


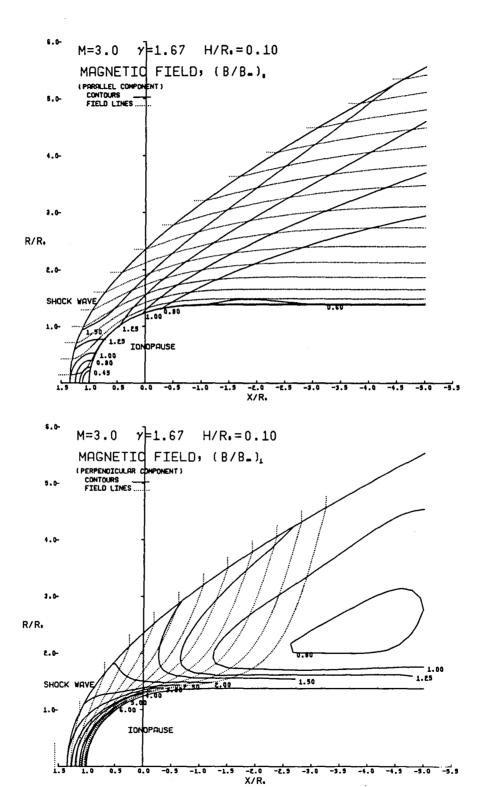


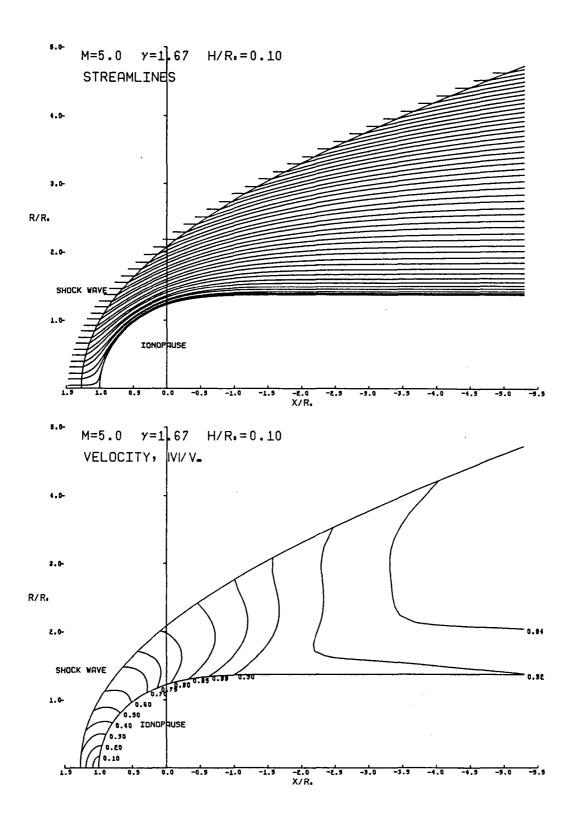


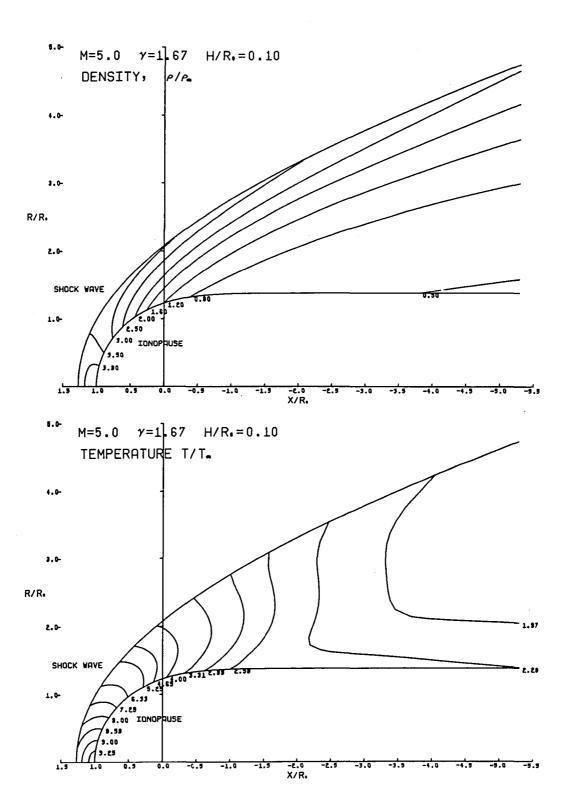


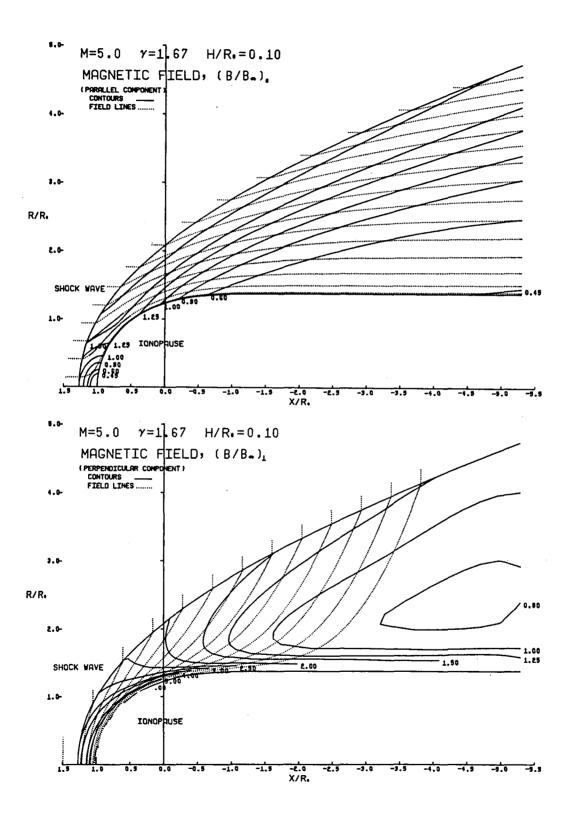


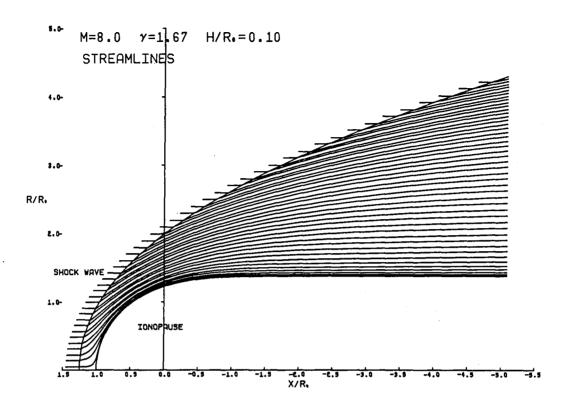


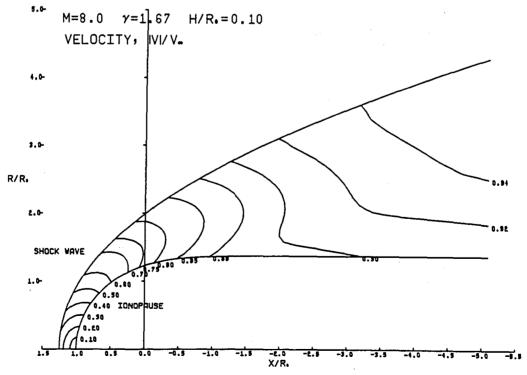


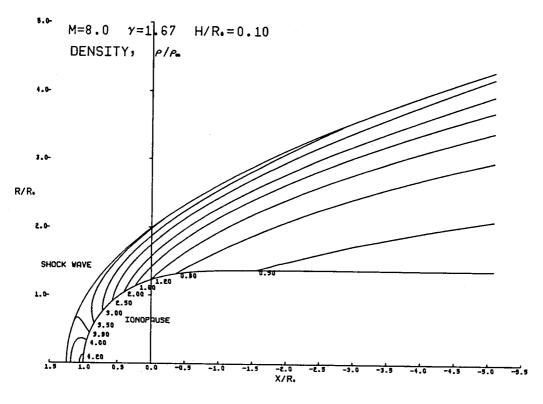


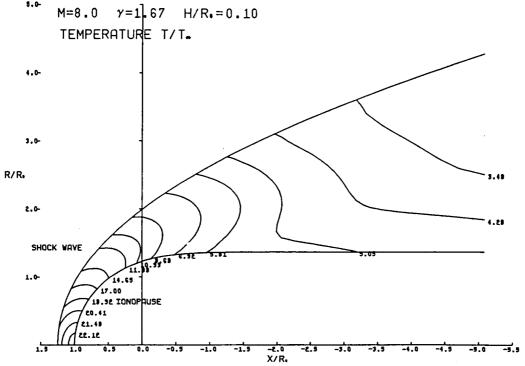


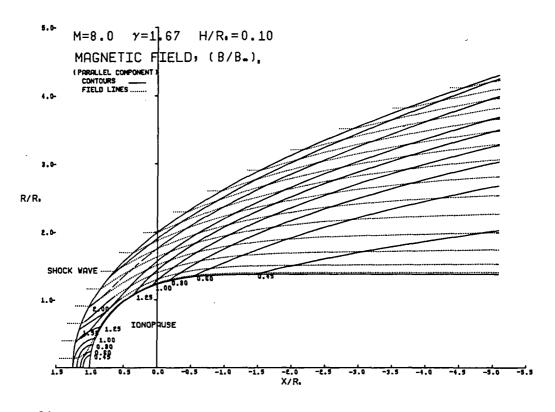


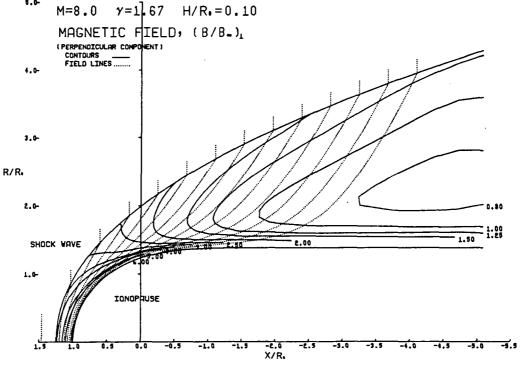


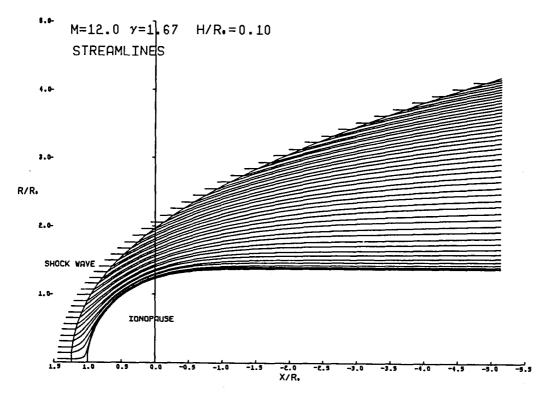


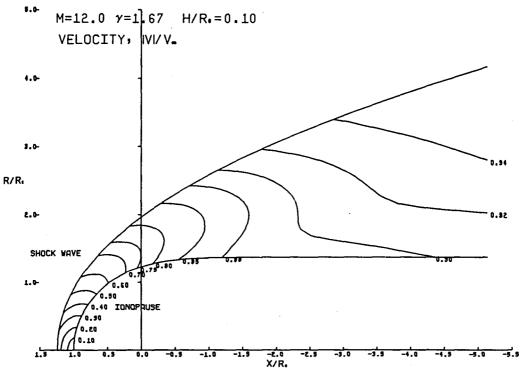


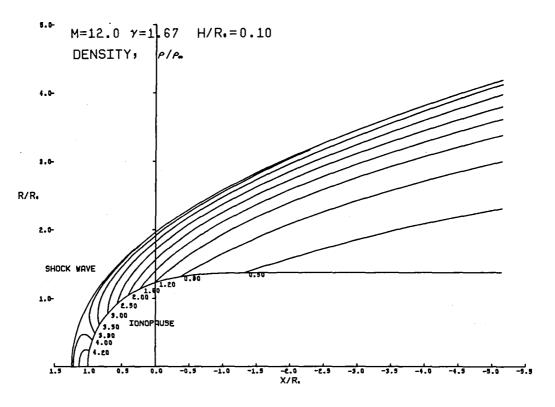


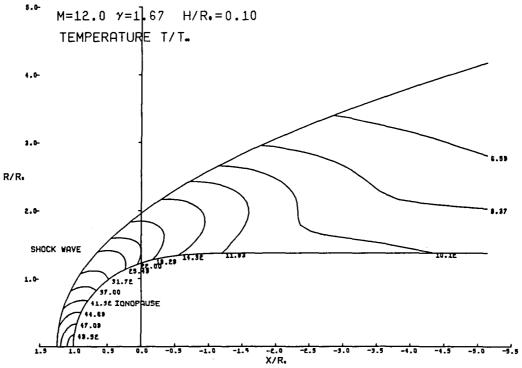


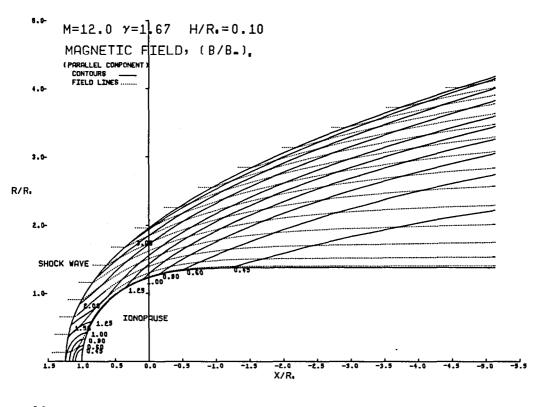


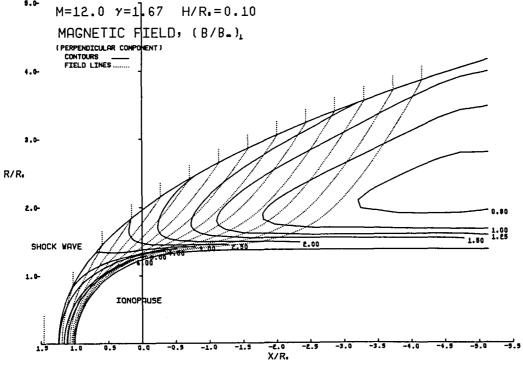


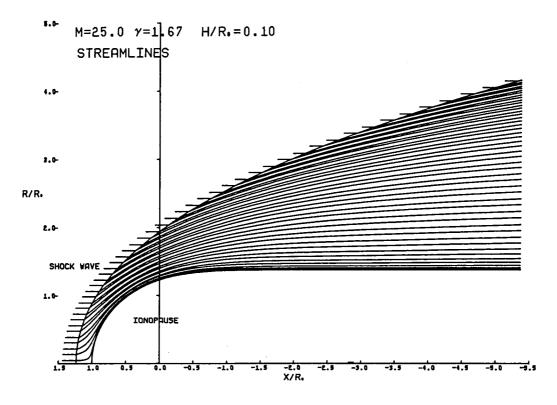


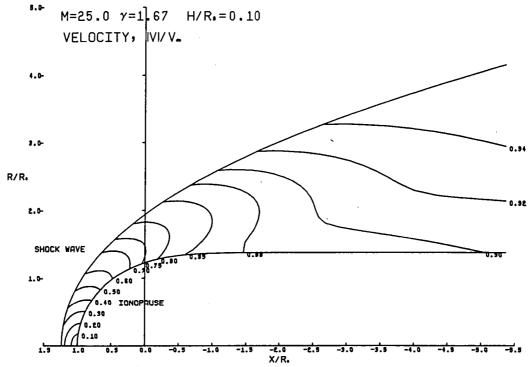


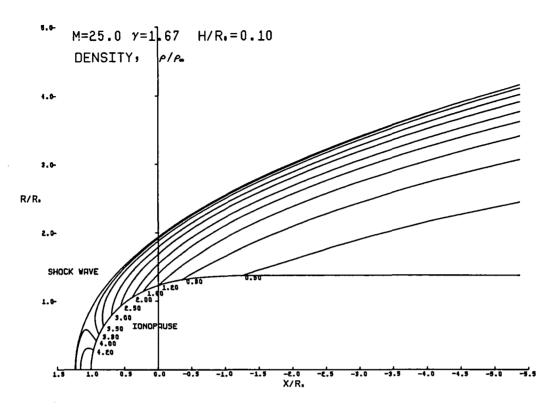


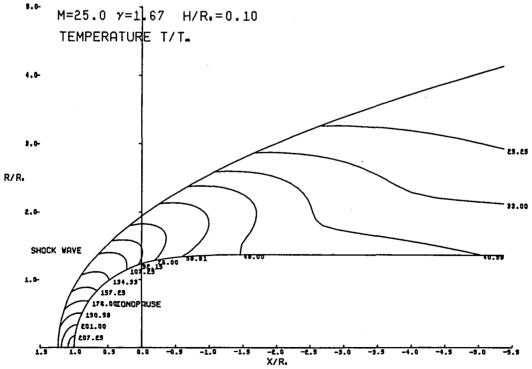


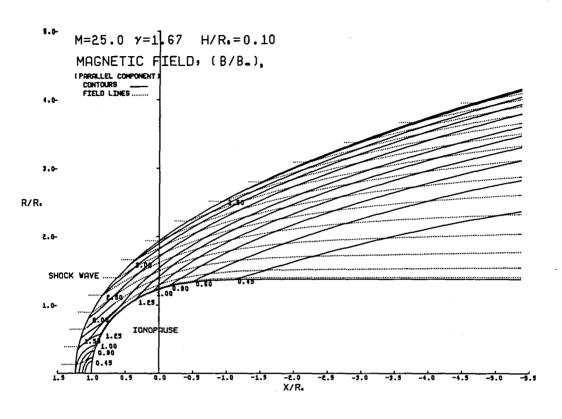


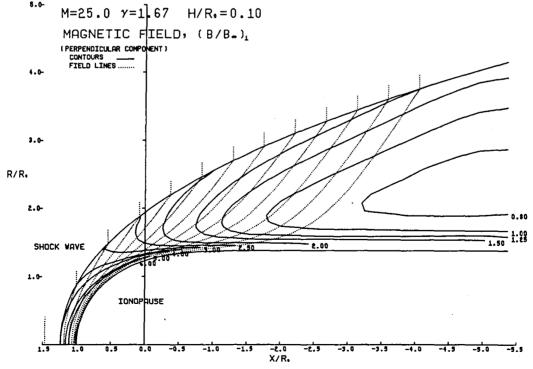


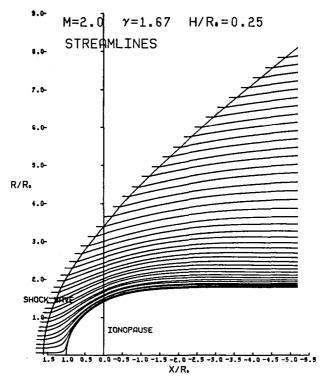


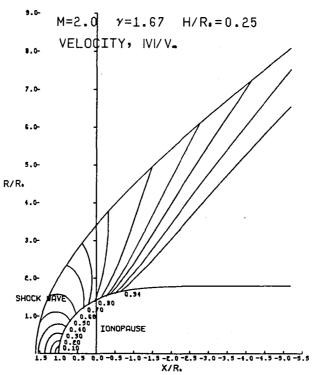


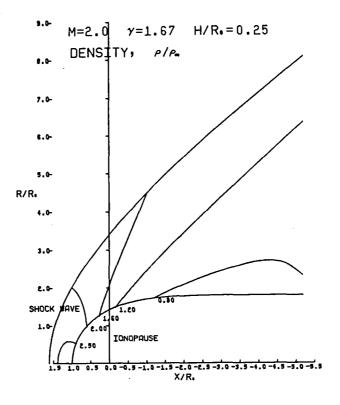


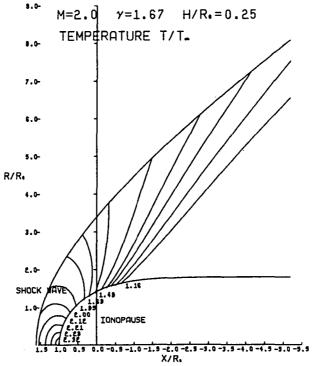


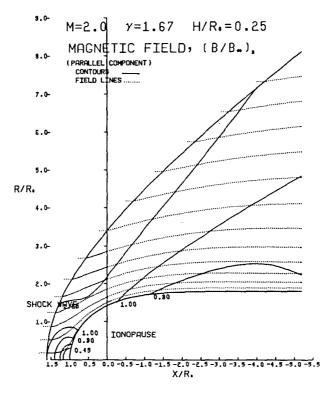


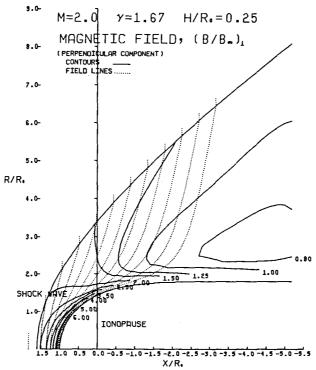


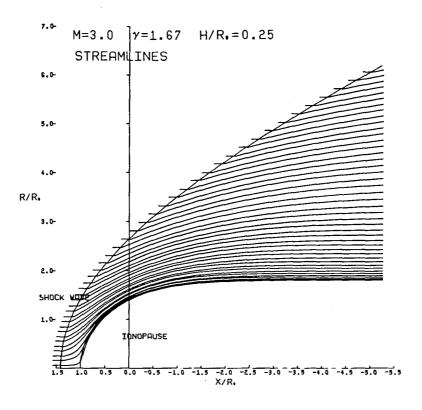


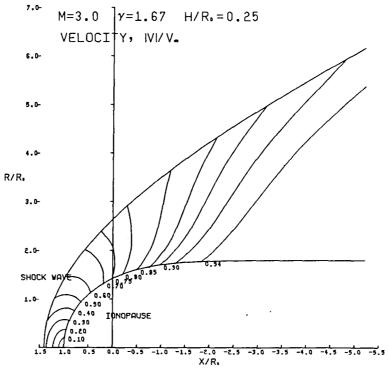


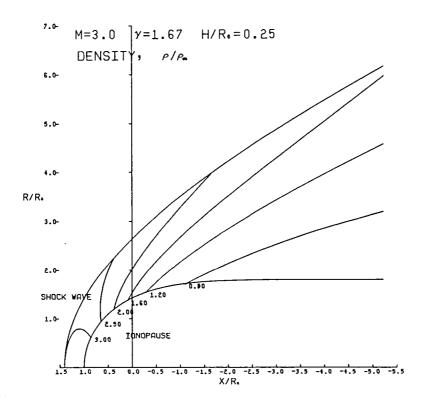


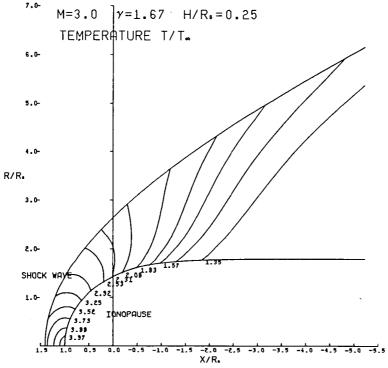


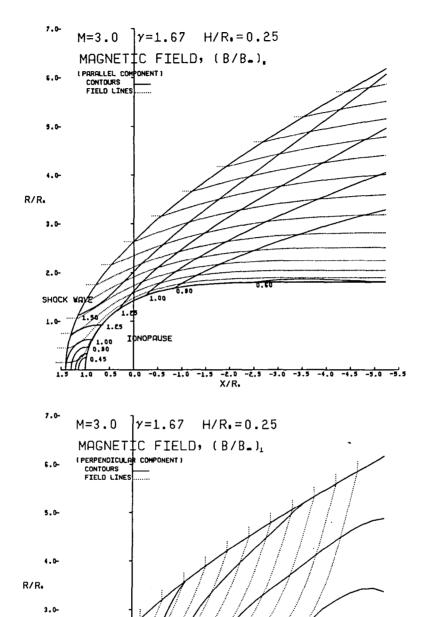












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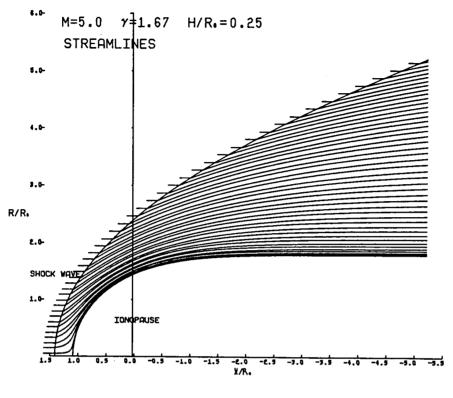
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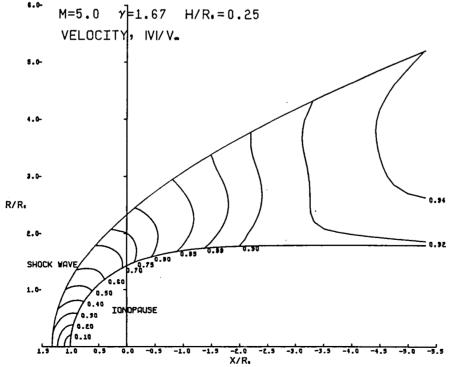
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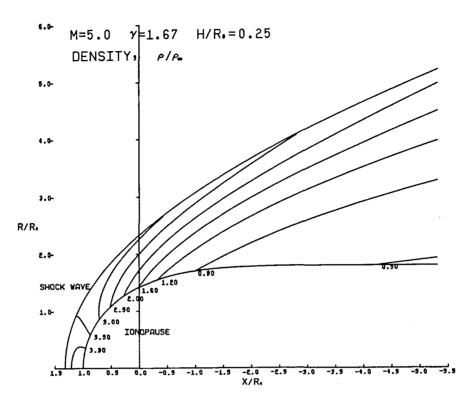
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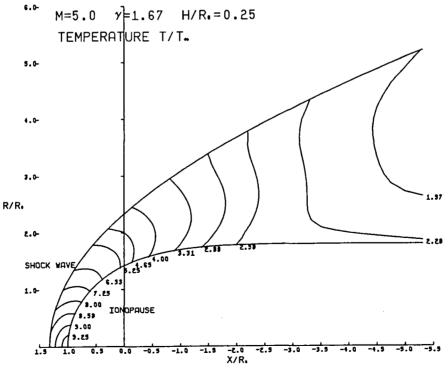
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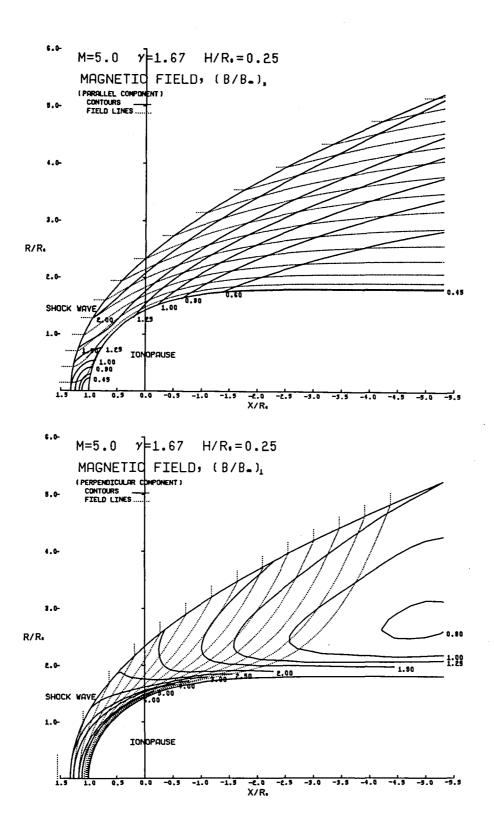
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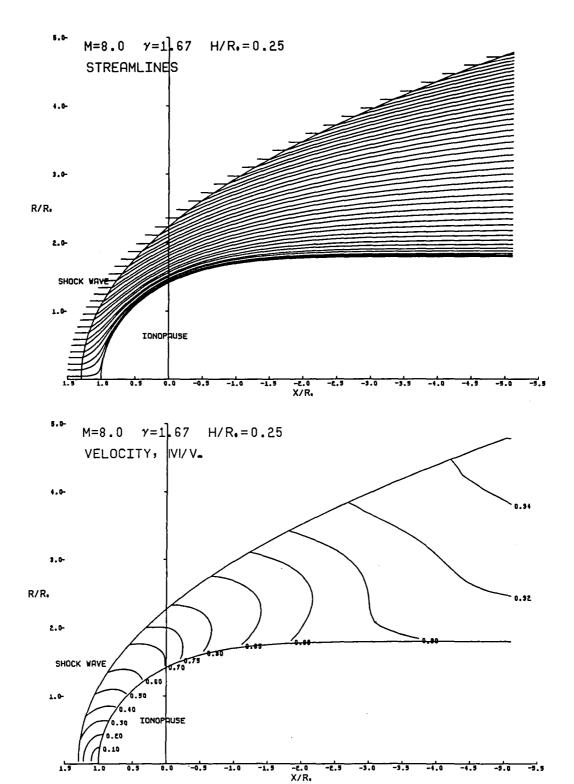


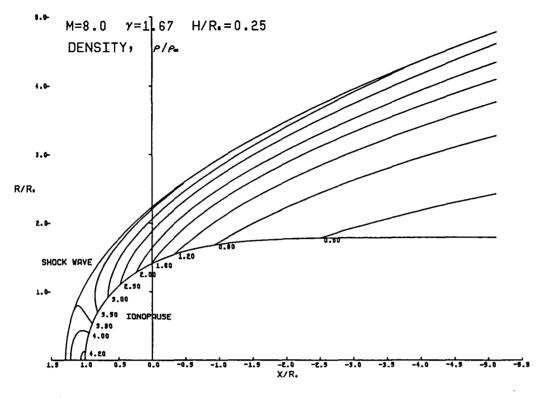


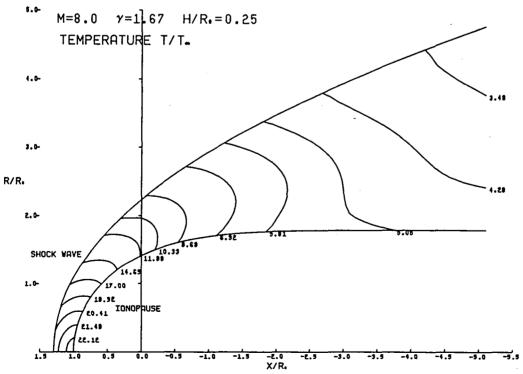


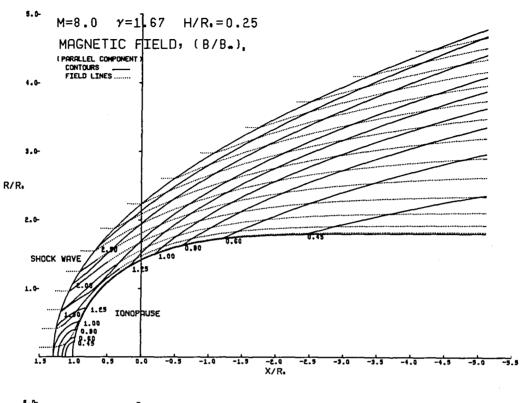


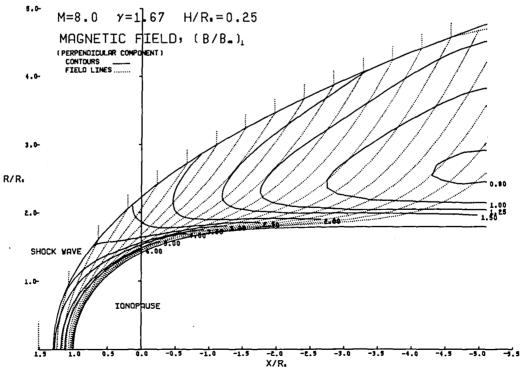


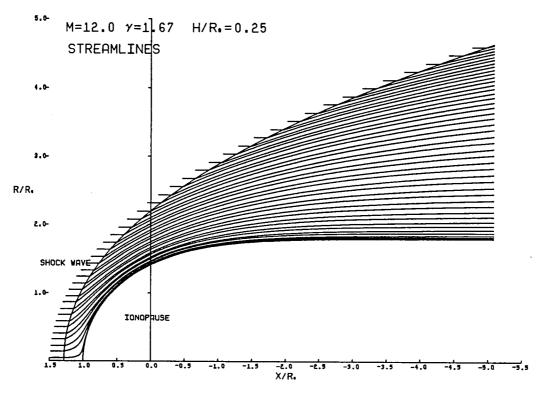


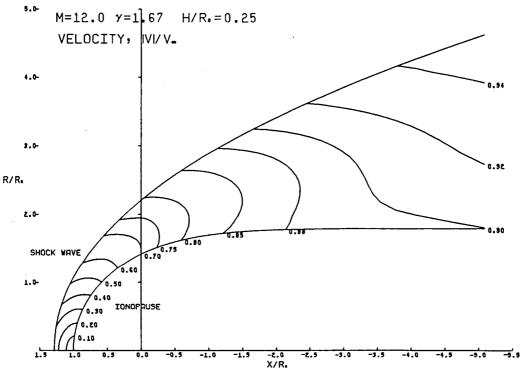


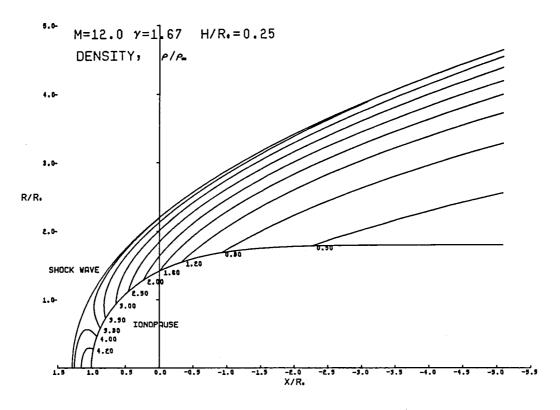


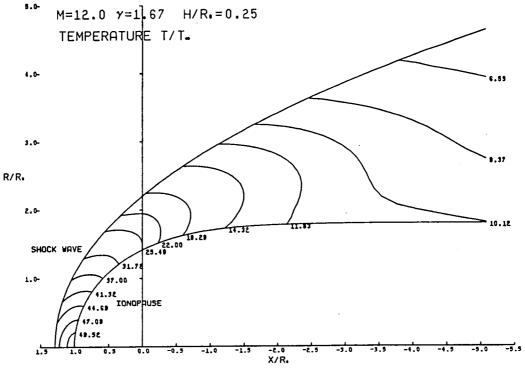


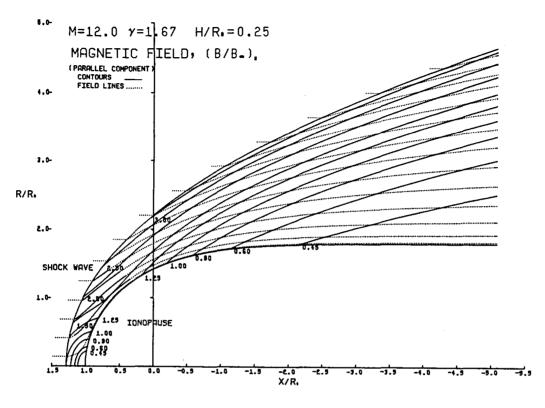


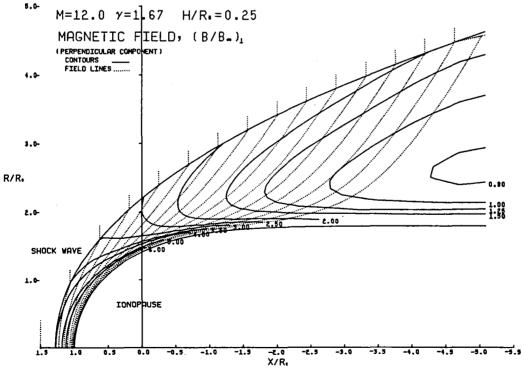


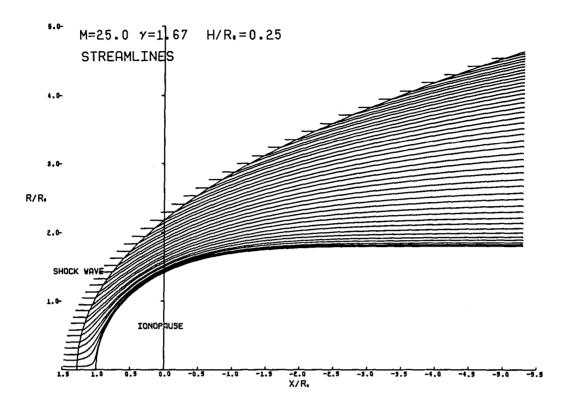


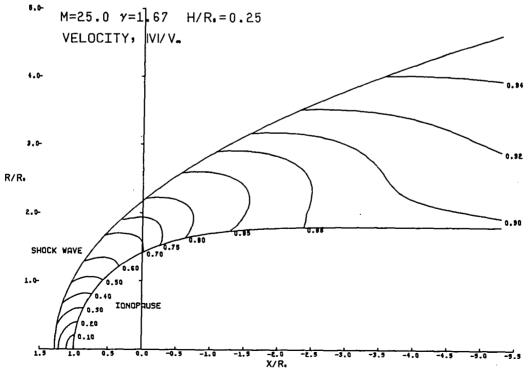


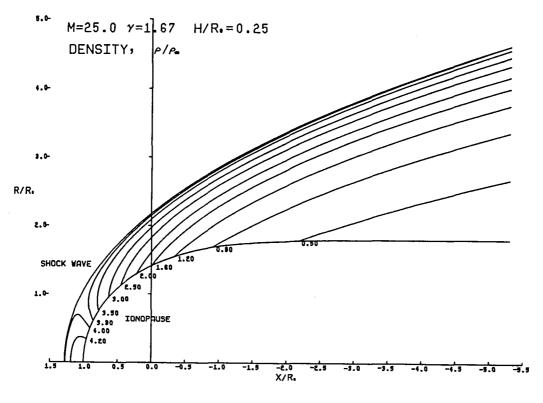


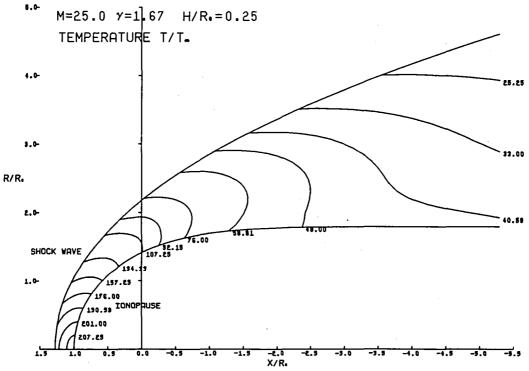


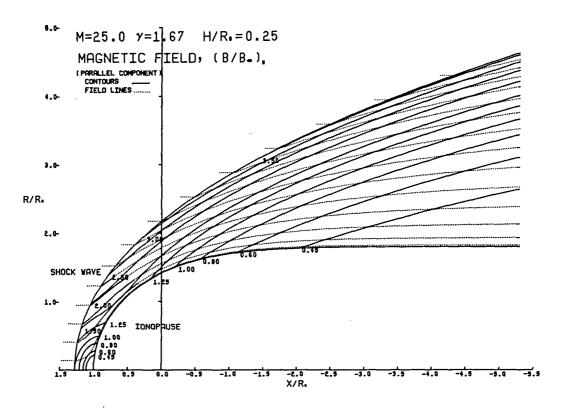


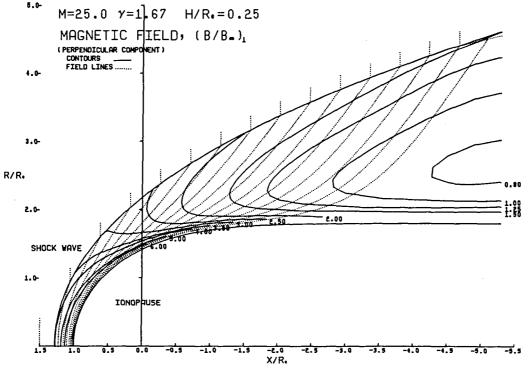


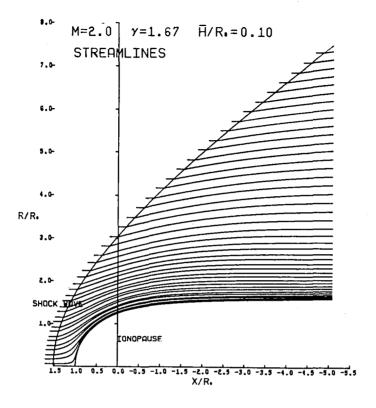


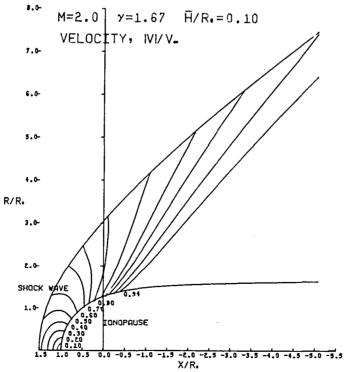


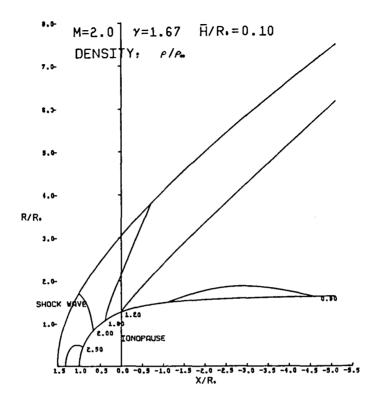


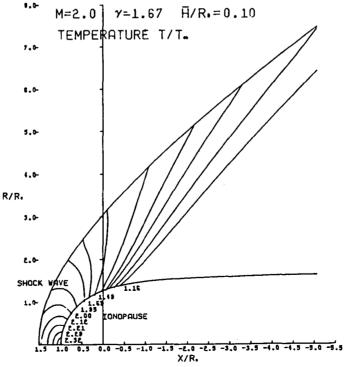


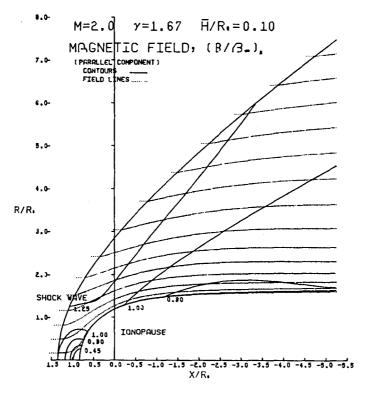


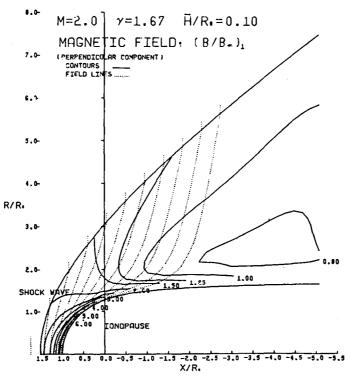


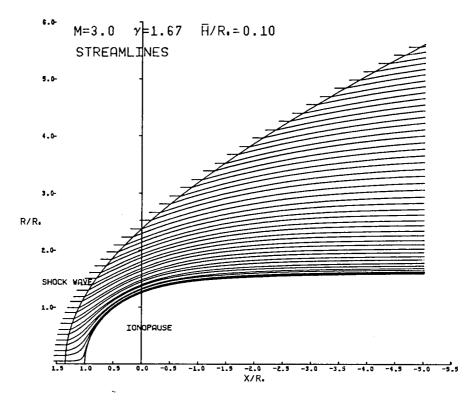


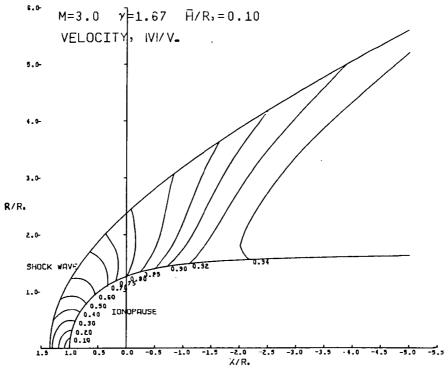


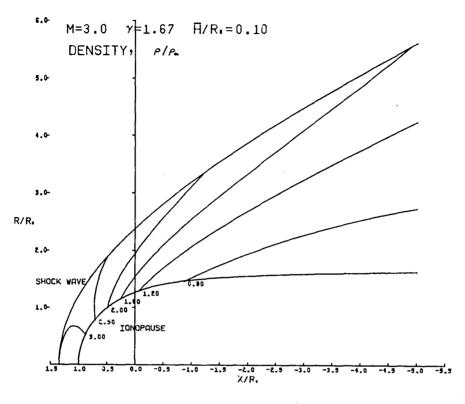


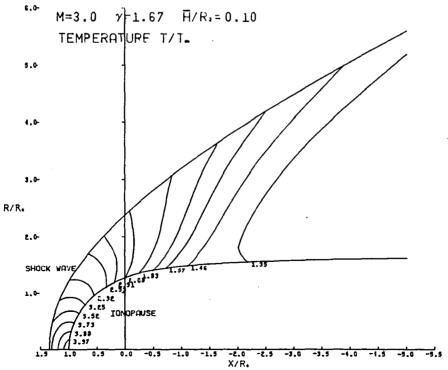


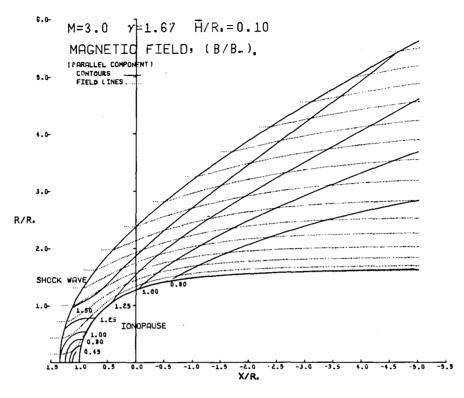


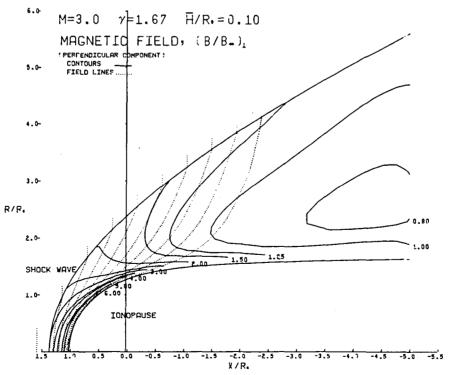


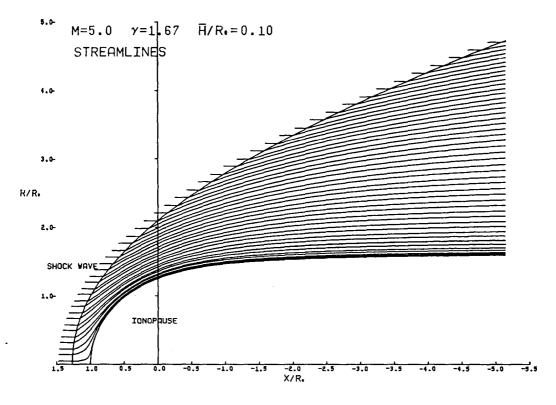


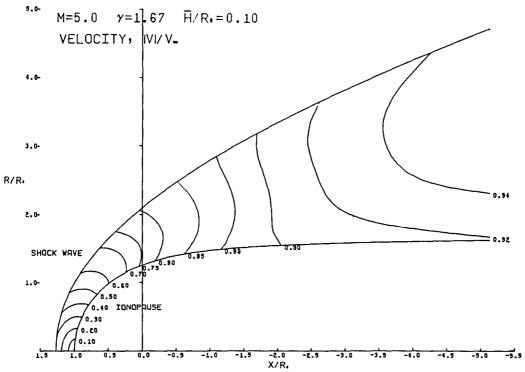


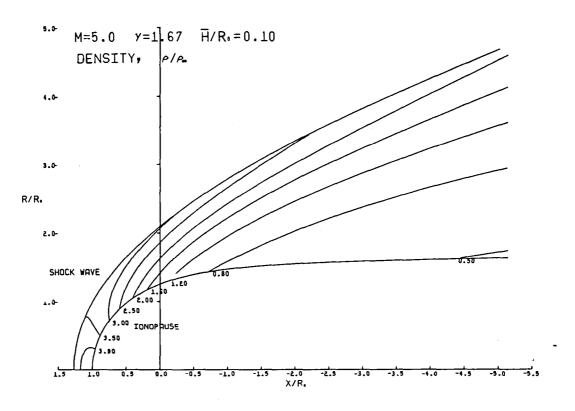


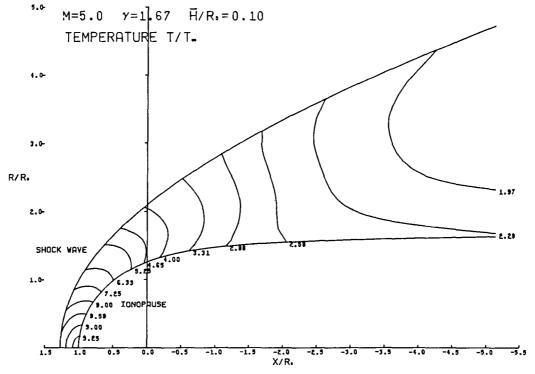


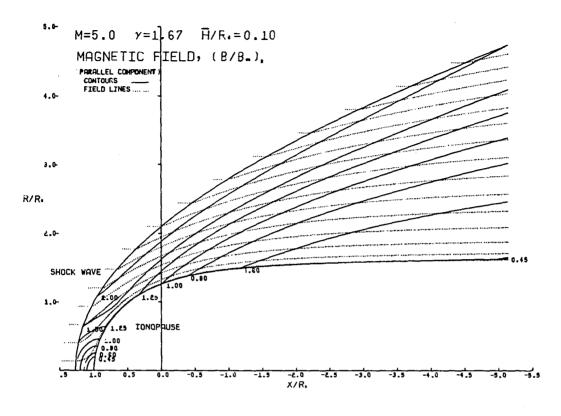


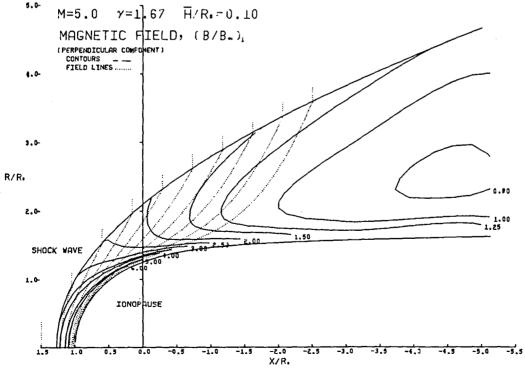


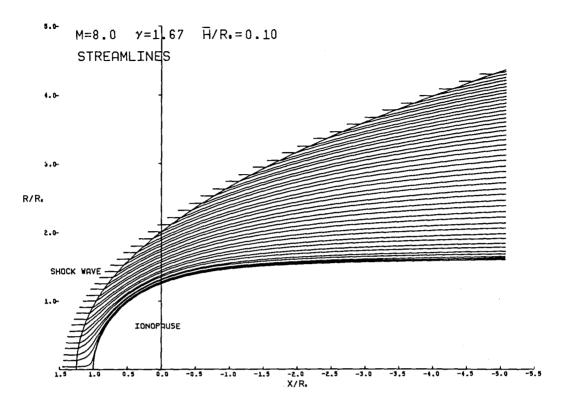


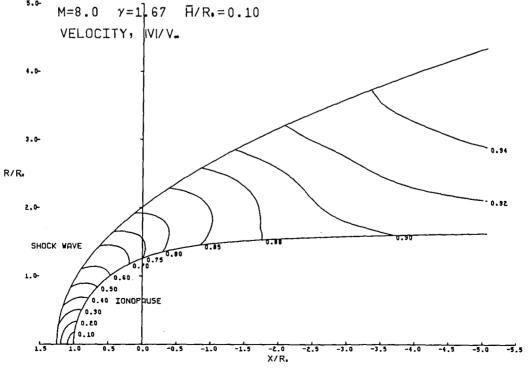


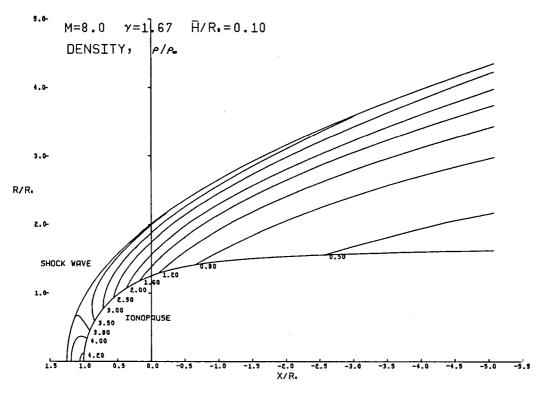


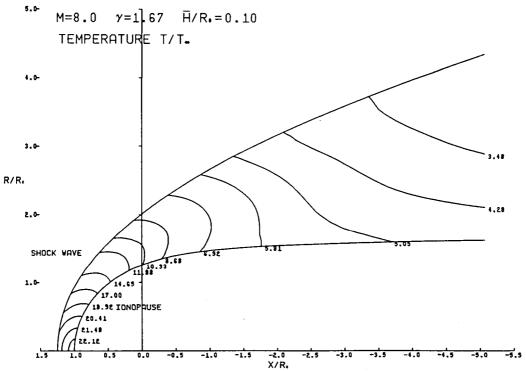


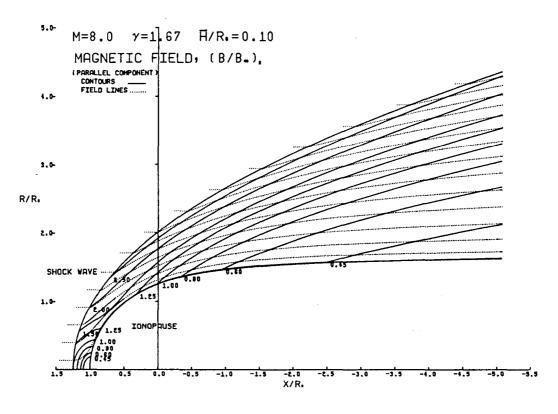


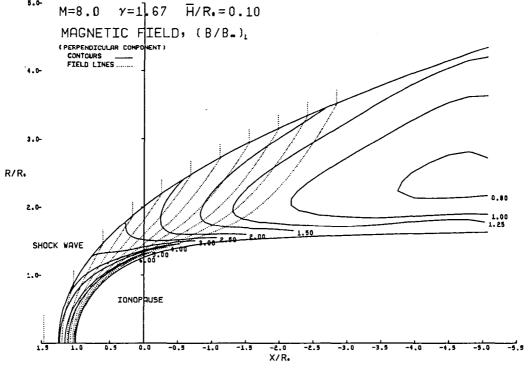


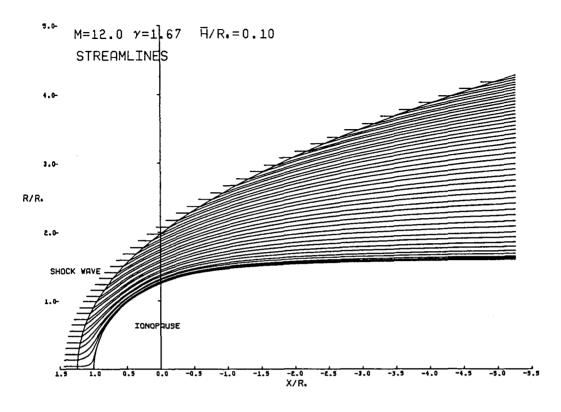


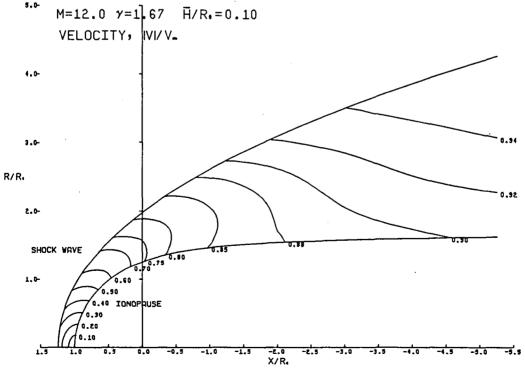


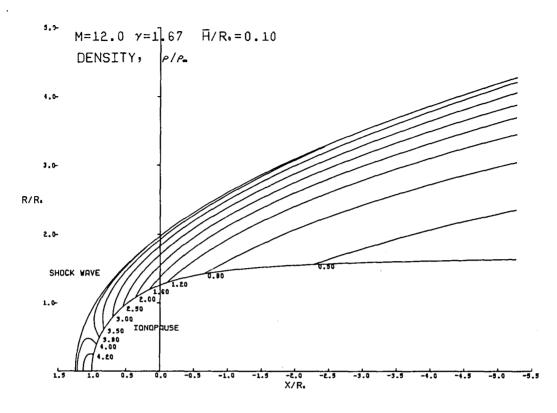


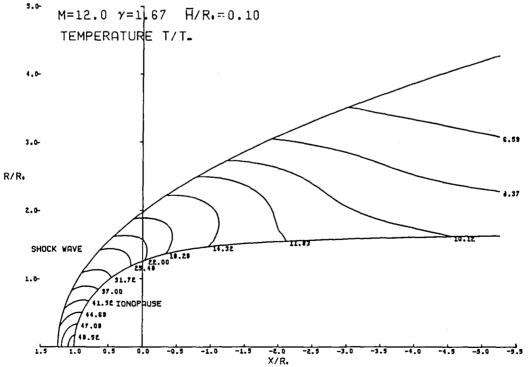


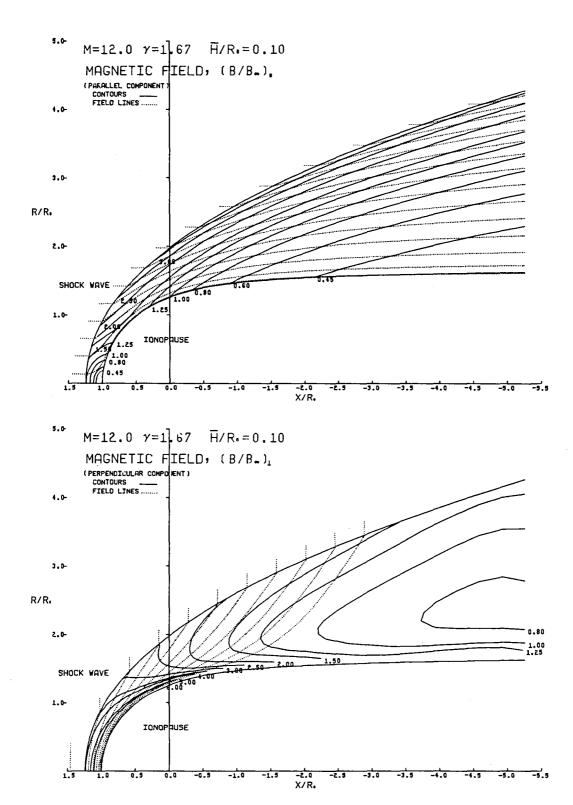


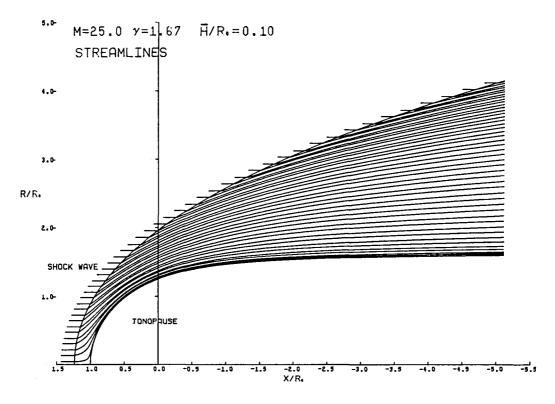


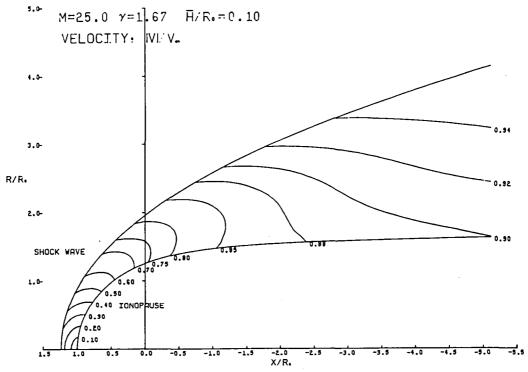


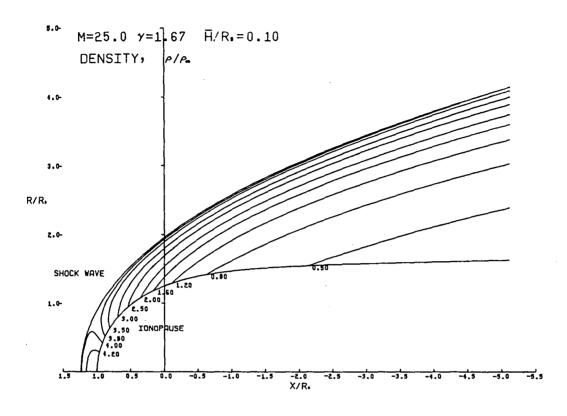


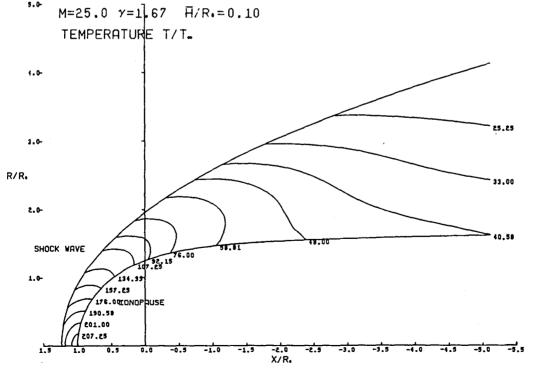


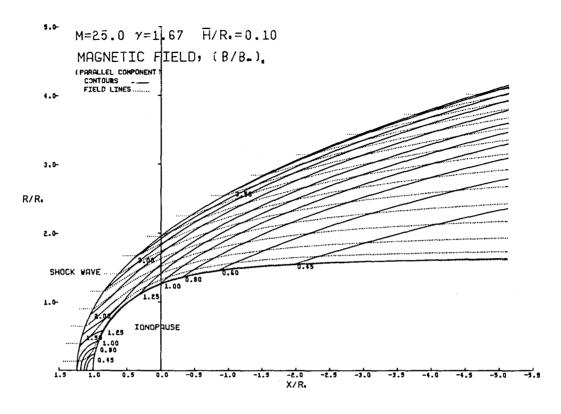


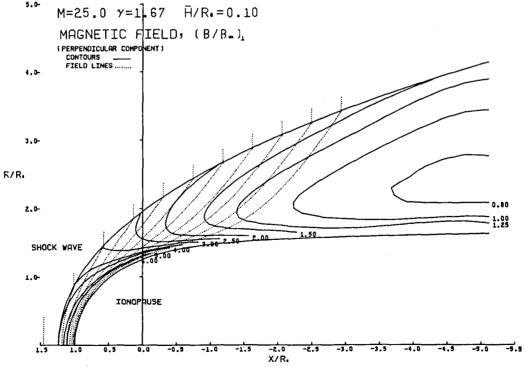


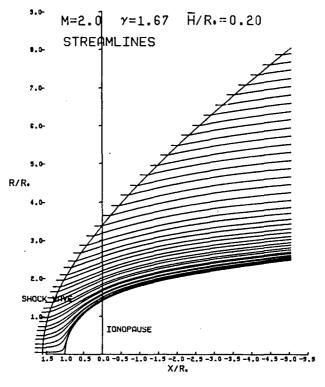


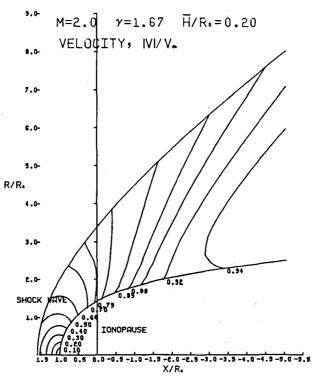


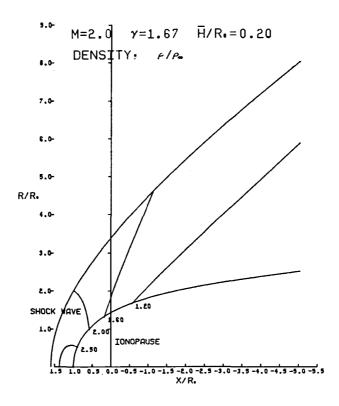


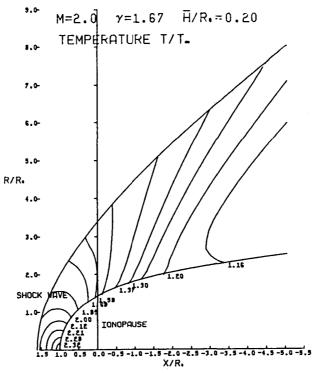


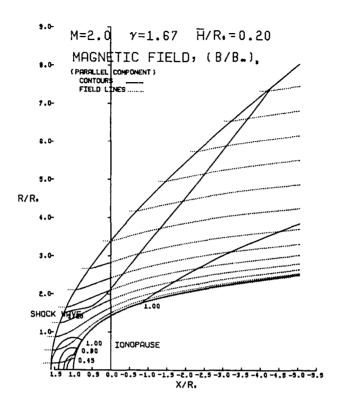


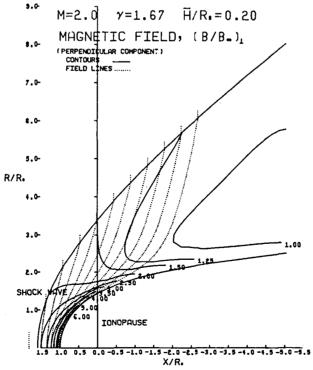


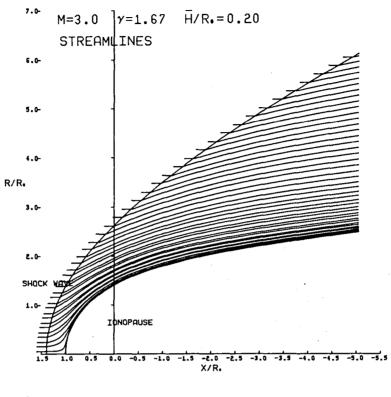


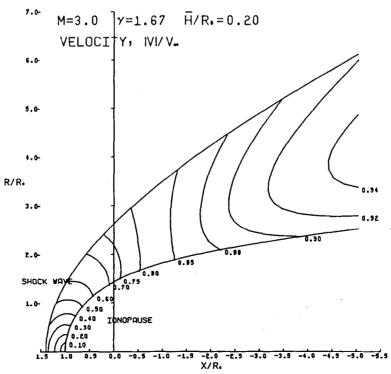


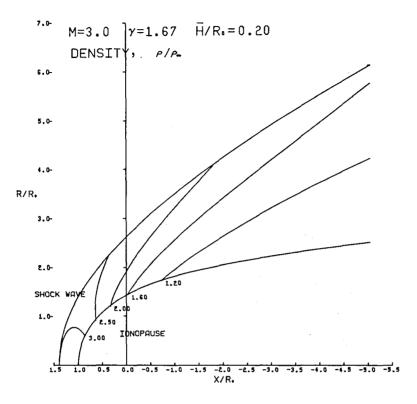


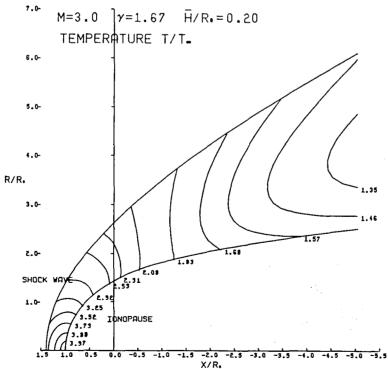


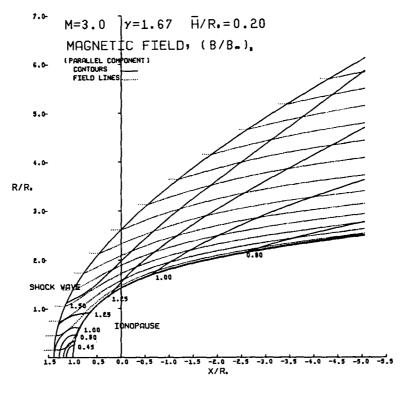


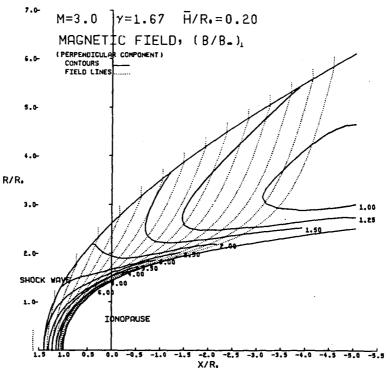


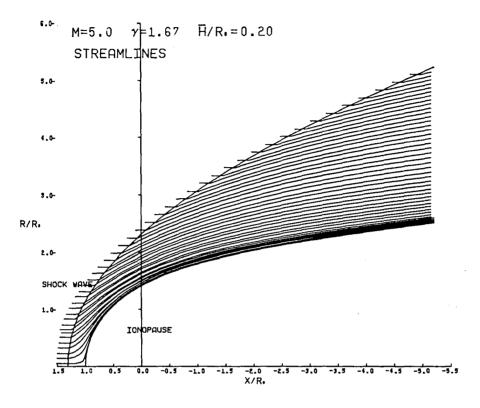


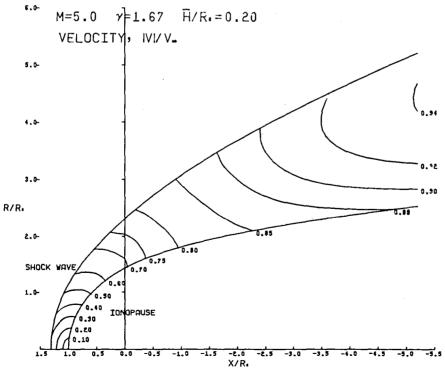


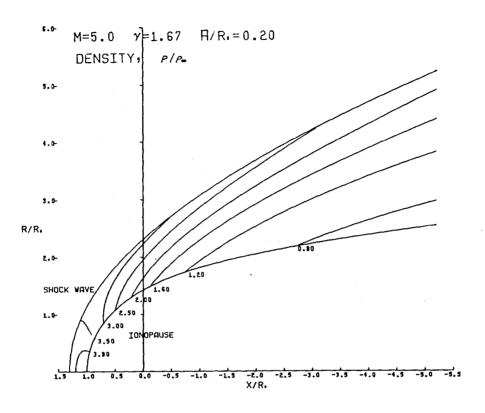


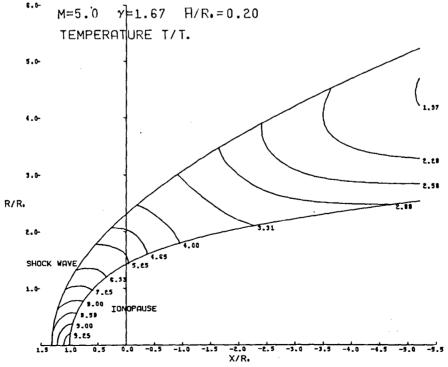


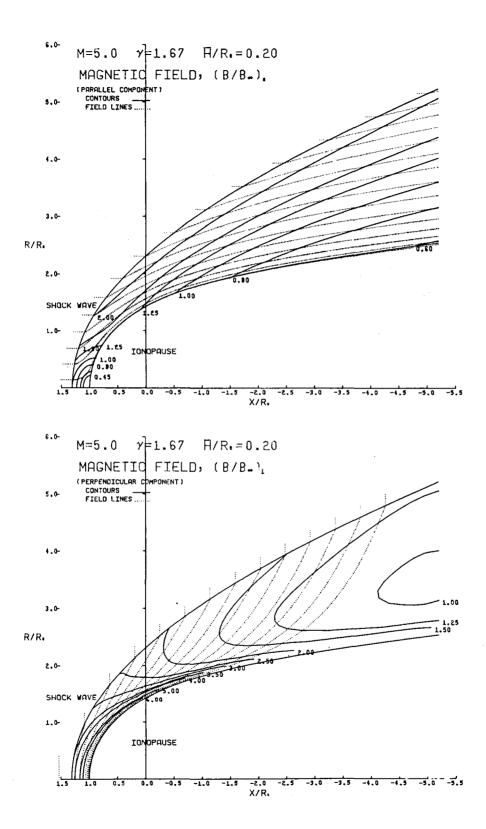


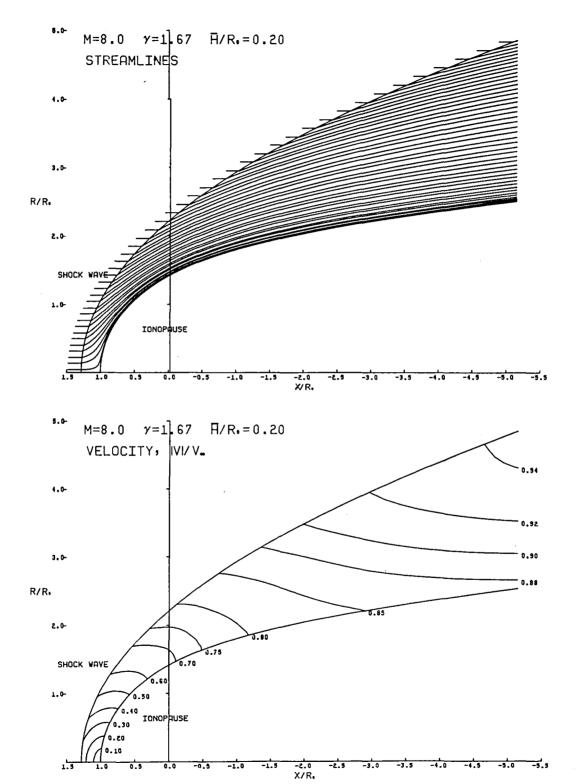


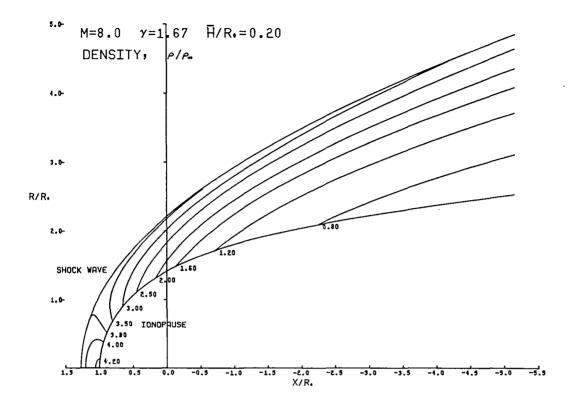


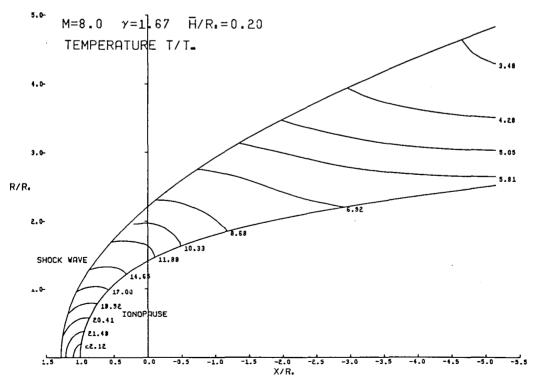


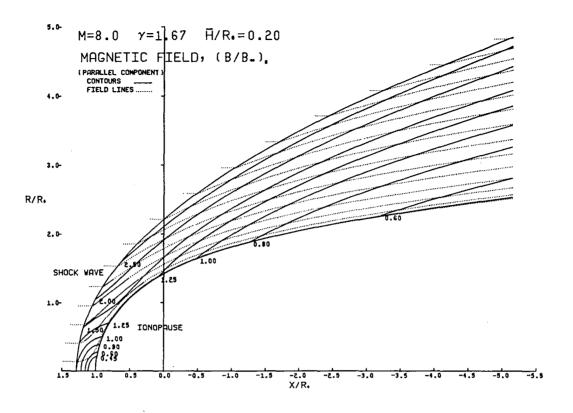


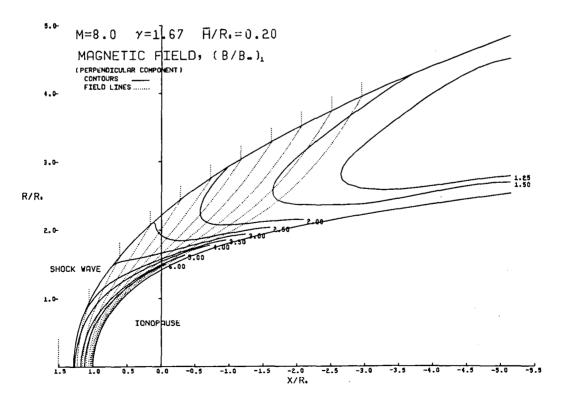


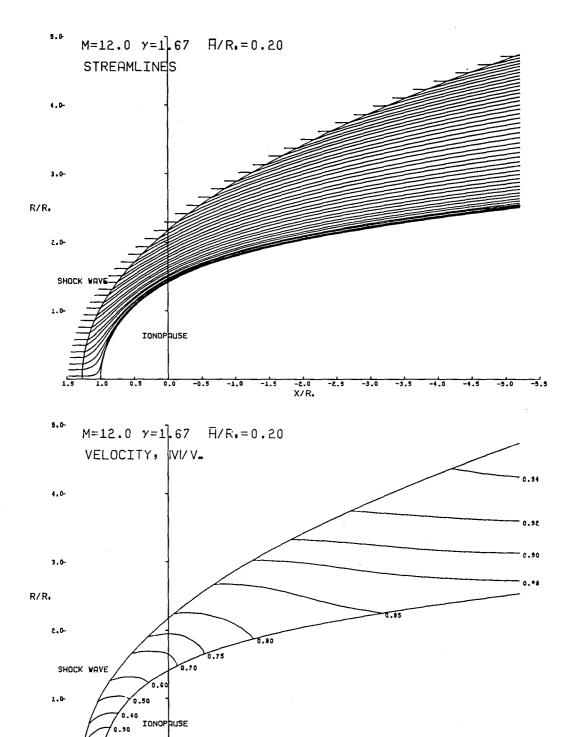




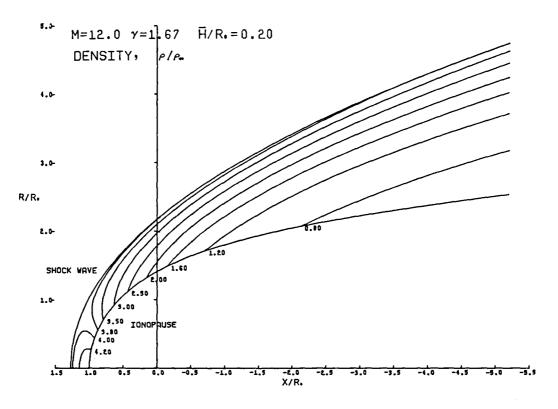


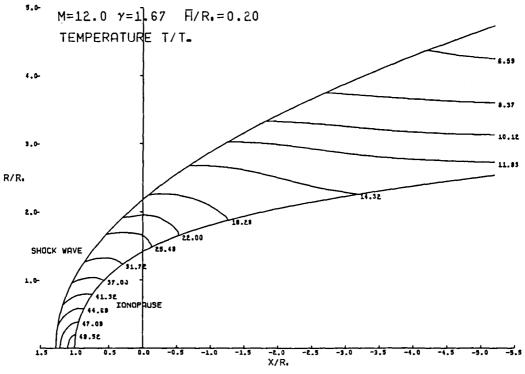


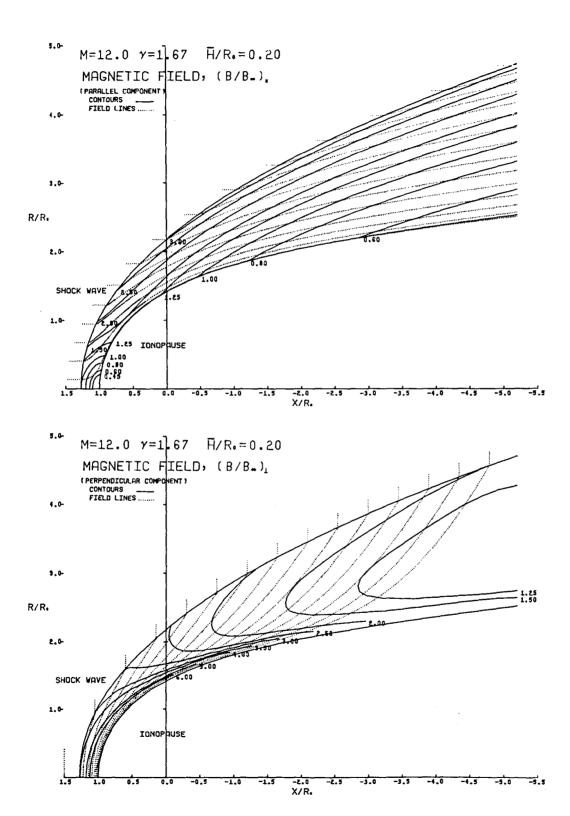


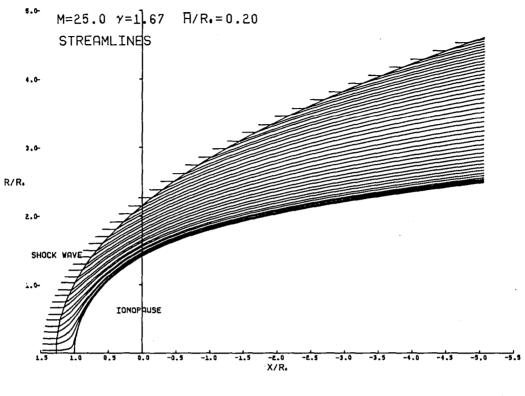


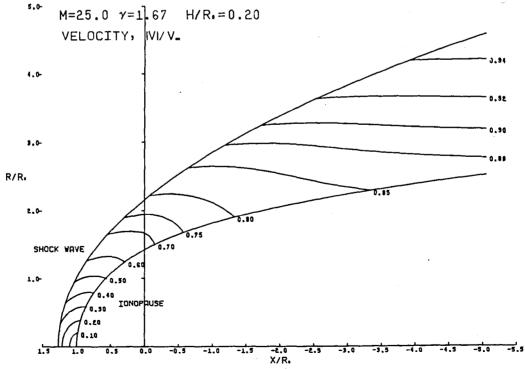
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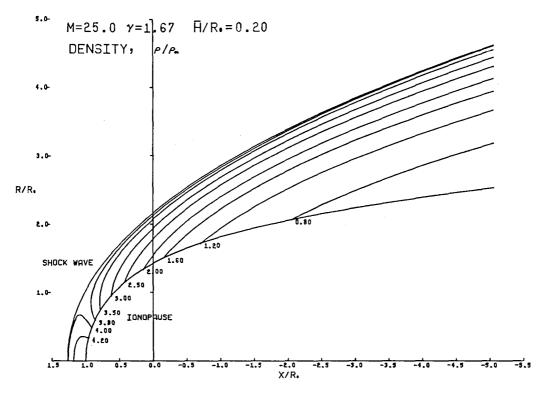


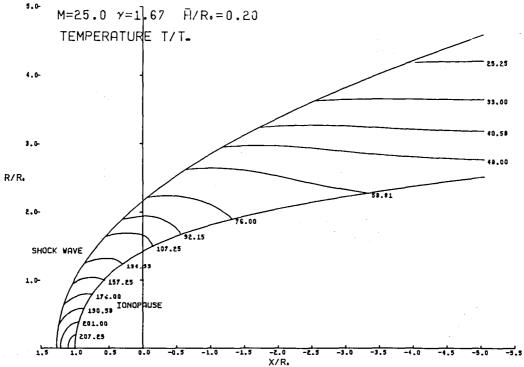


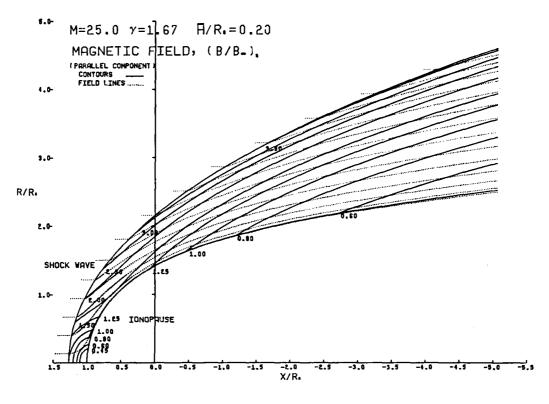


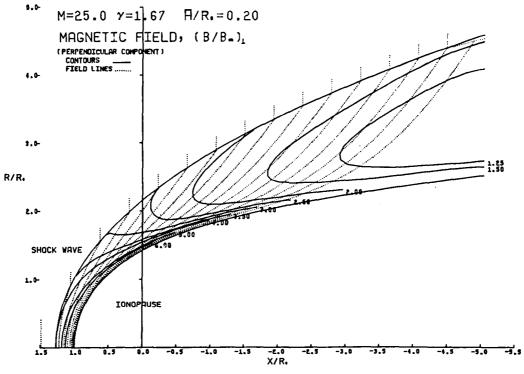


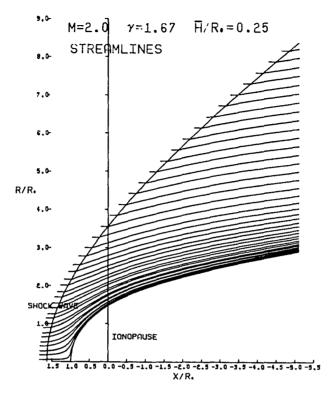


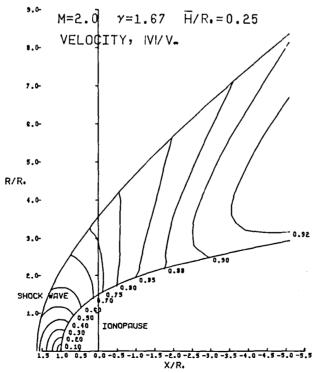


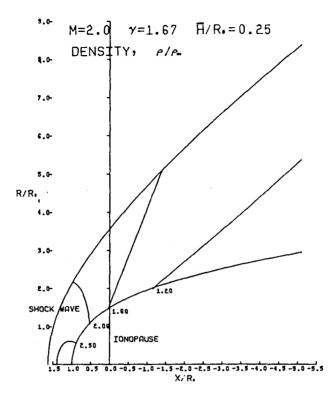


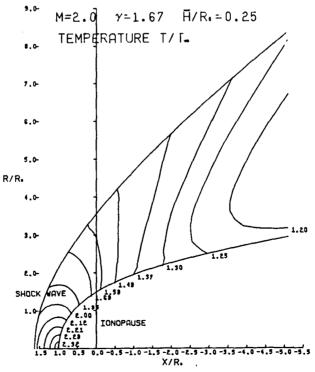


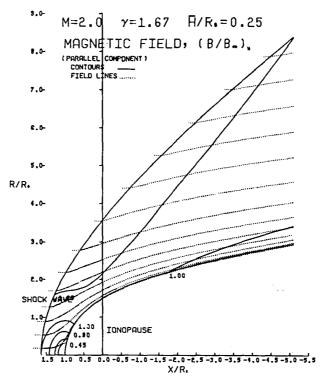


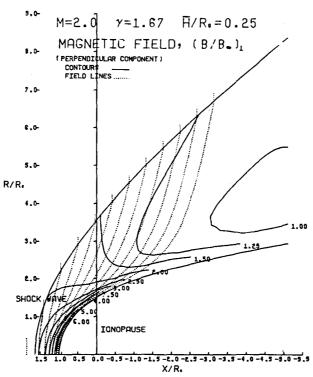


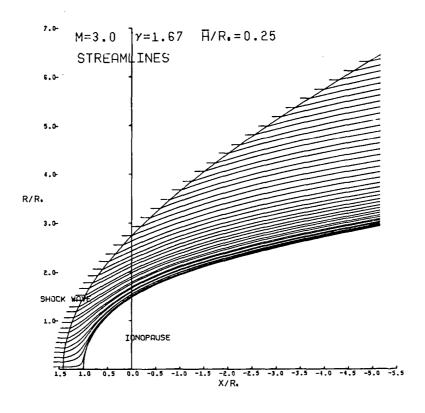


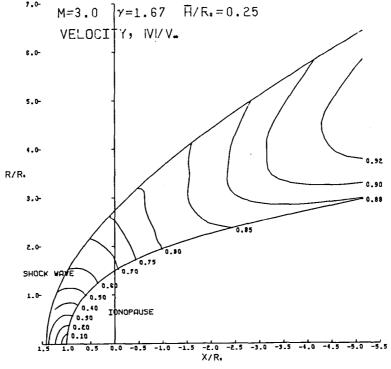


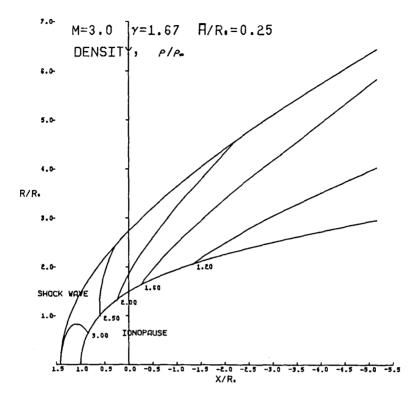


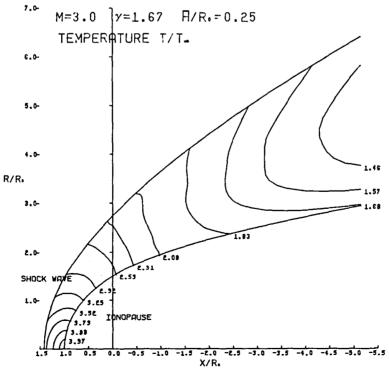


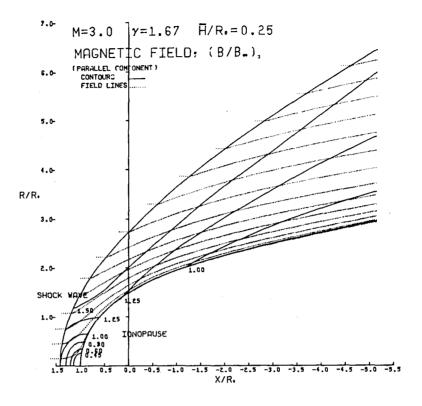


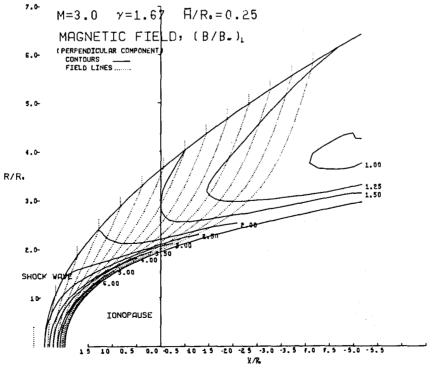


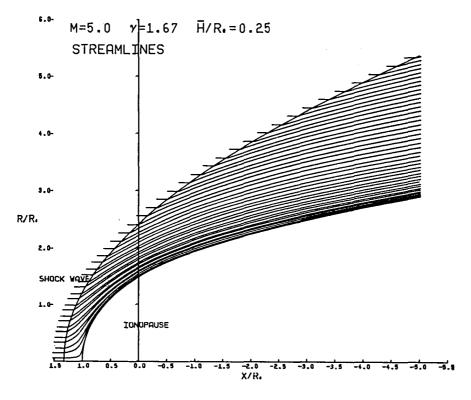


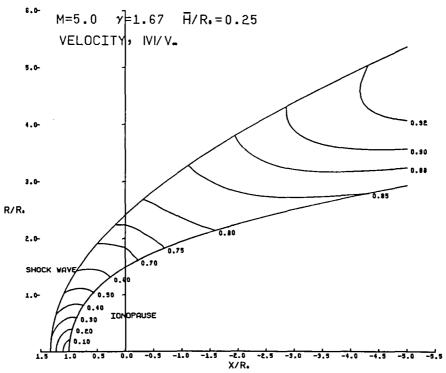


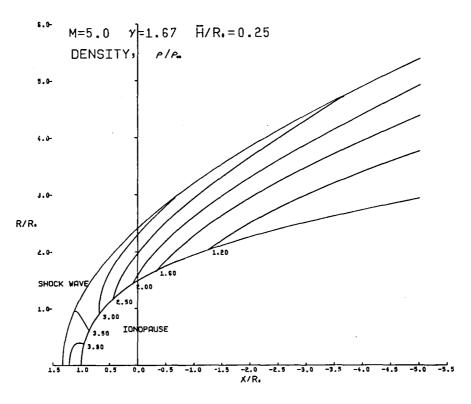


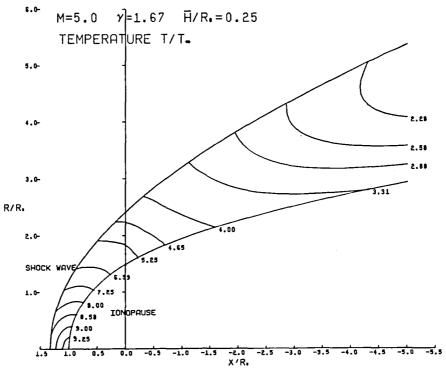


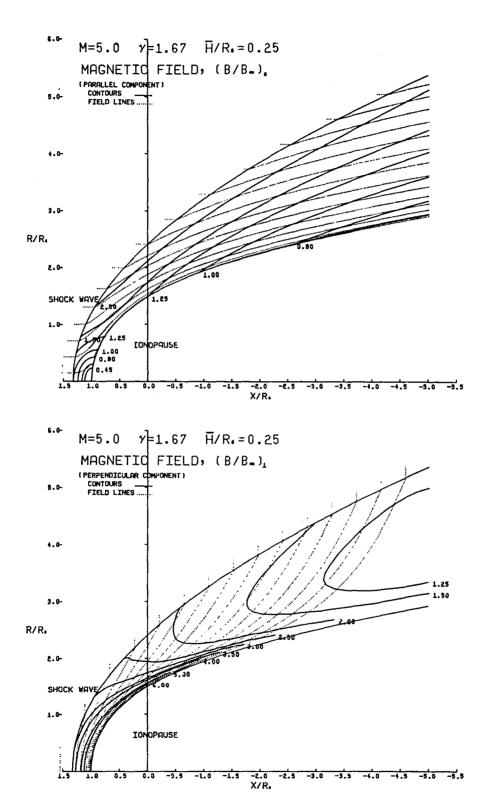


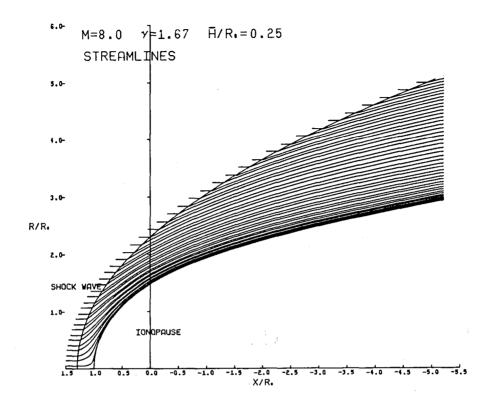


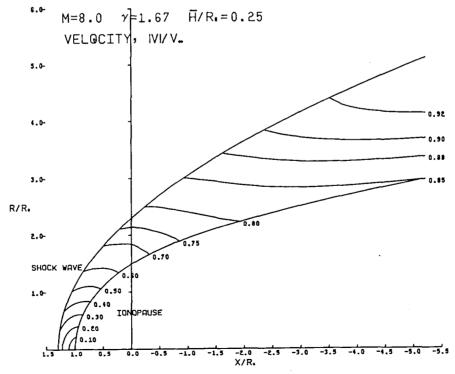


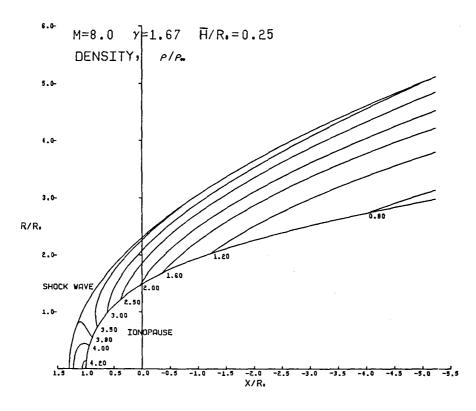


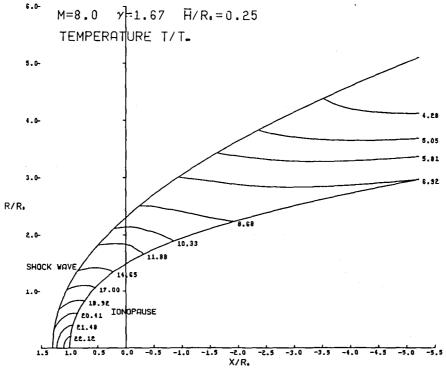


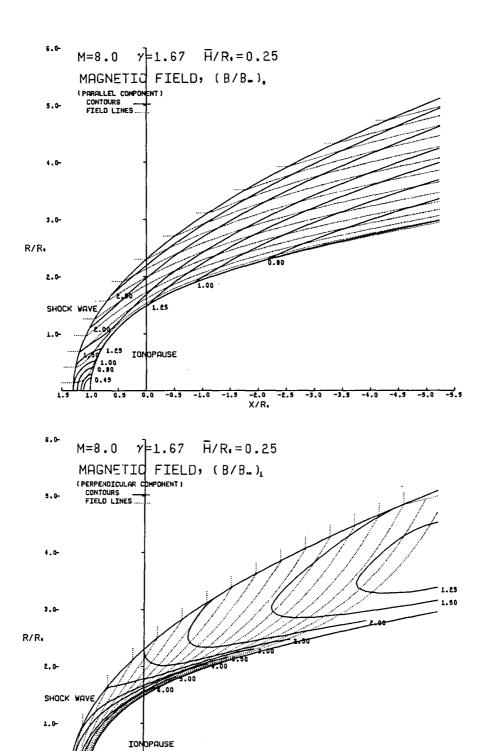




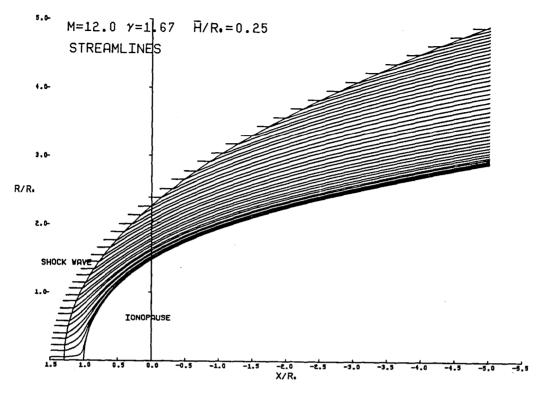


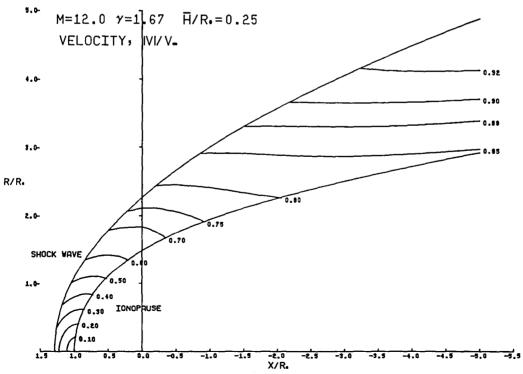


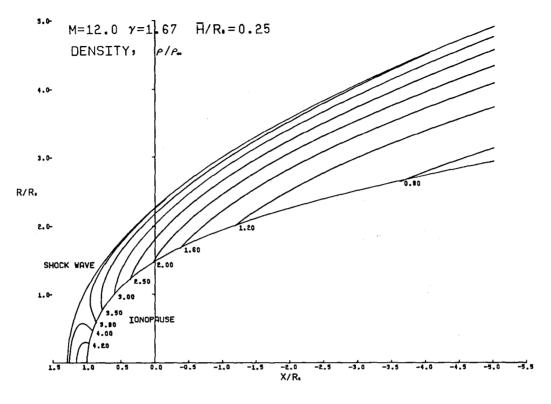


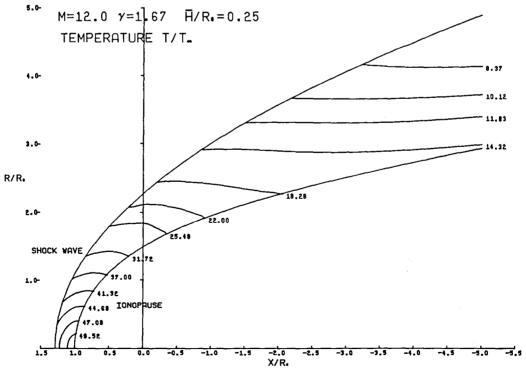


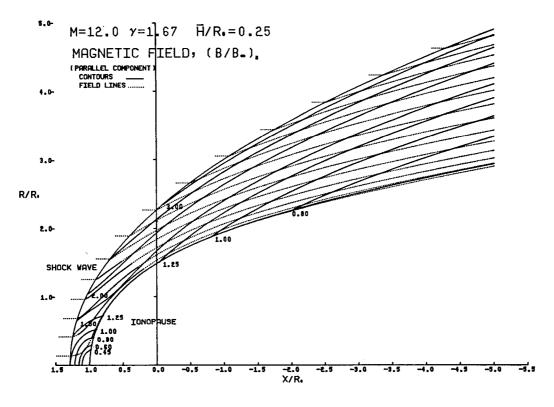
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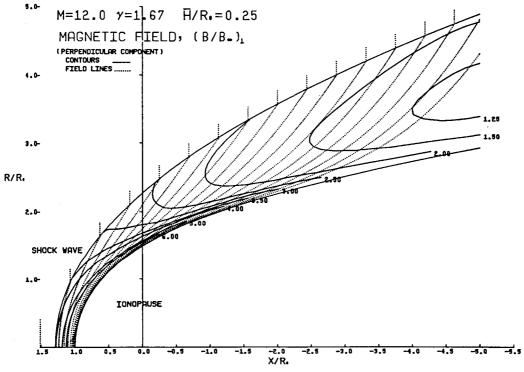


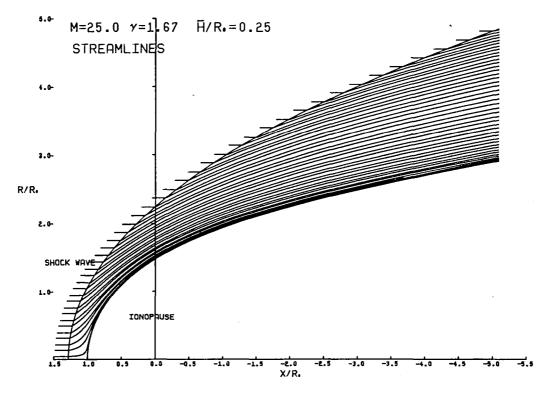


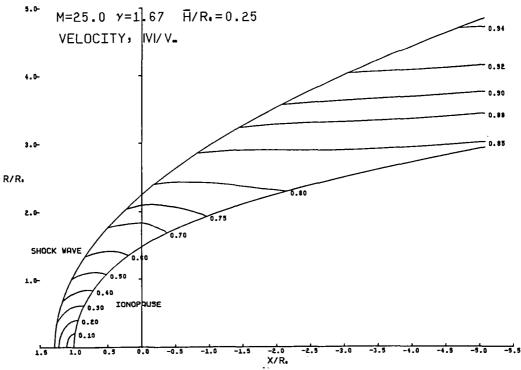


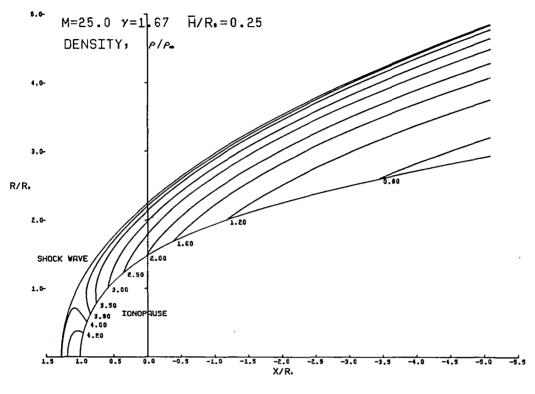


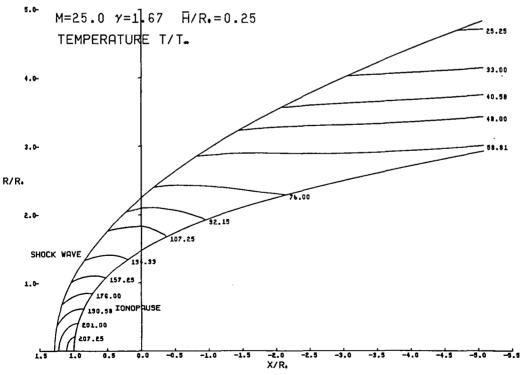


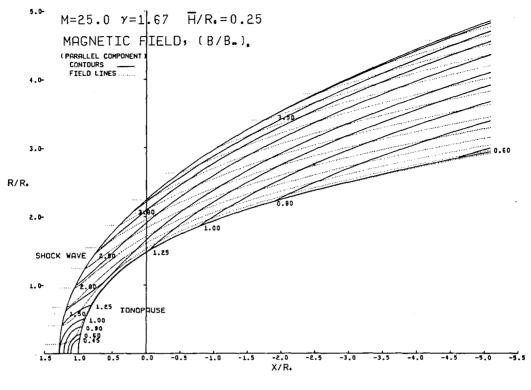


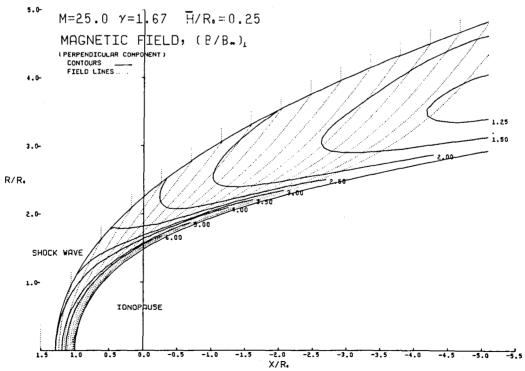












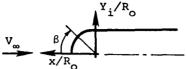
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Table 1.- Ordinates of Various Ionopause Shapes



	IONOPAUSE		IONOPAUSE		IONOPAUSE		IONOPAUSE		IONOPAUSE	
	$\overline{H}/R_0 = 0.01$		$\overline{H}/R_0 = 0.05$		$\overline{H}/R_0 = 0.10$		$\overline{H}/R_0 = 0.20$		$\overline{H}/R_0 = 0.25$	
β	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o
0°	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
2°	0.9994	0.0349	0.9995	0.0349	0.9995	0.0349	0.9995	0.0349	0.9996	0.0349
6°	0.9946	0.1045	0.9950	0.1046	0.9953	0.1046	0.9958	0.1047	0.9960	0.1047
10°	0.9851	0.1737	0.9861	0.1739	0.9870	0.1740	0.9883	0.1743	0.9888	0.1744
14°	0.9709	0.2421	0.9727	0.2425	0.9746	0.2430	0.9771	0.2436	0.9781	0.2439
18°	0.9520	0.3093	0.9550	0.3103	0.9580	0.3113	0.9622	0.3126	0.9638	0.3132
22°	0.9285	0.3751	0.9330	0.3770	0.9374	0.3787	0.9435	0.3812	0.9459	0.3822
26°	0.9006	0.4393	0.9068	0.4423	0.9127	0.4451	0.9211	0.4492	0.9243	0.4508
30°	0.8684	0.5014	0.8764	0.5060	0.8840	0.5104	0.8949	0.5167	0.8991	0.5191
34°	0.8320	0.5612	0.8419	0.5679	0.8514	0.5743	0.8649	0.5834	0.8701	0.5869
38°	0.7916	0.6185	0.8035	0.6278	0.8148	0.6366	0.8312	0.6494	0.8374	0.6543
42°	0.7474	0.6729	0.7613	0.6854	0.7745	0.6973	0.7935	0.7145	0.8009	0.7211
46°	0.6995	0.7243	0.7153	0.7407	0.7303	0.7563	0.7520	0.7787	0.7604	0.7874
50°	0.6482	0.7725	0.6658	0.7934	0.6824	0.8133	0.7066	0.8421	0.7159	0.8532
54°	0.5937	0.8172	0.6128	0.8435	0.6309	0.8683	0.6571	0.9044	0.6673	0.9184
58°	0.5363	0.8582	0.5565	0.8906	0.5756	0.9212	0.6035	0.9657	0.6143	0.9831
62°	0.4761	0.8954	0.4971	0.9349	0.5168	0.9719	0.5456	1.0261	0.5569	1.0473
66°	0.4135	0.9287	0.4346	0.9761	0.4543	1.0203	0.4504	1.1147	0.4947	1.1744
70°	0.3487	0.9581	0.3691	1.0142	0.3882	1.0665	0.4163	1.1437	0.4274	1.1744
74°	0.2820	0.9833	0.3009	1.0492	0.3184	1.1103	0.3444	1.2010	0.3548	1.2374
78°	0.2135	1.0046	0.2298	1.0811	0.2448	1.1517		1.2574	0.2764	1.3001
82°	0.1436	1.0219	0.1560	1.1098	0.1674	1.1908	0.1845	1.3130	0.1915	1.3628
86°	0.0724	1.0354	0.0794	1.1355	0.0858	1.2276	0.0956	1.3677	0.0997	1.4254
90°	0.0000	1.0454	0.0000	1.1583	0.0000	1.2620	0.0000	1.4218	0.0000	1.4883
94°	-0.0736	1.0523	-0.0824	1.1782	-0.0905	1.2943	-0.1032	1.4753	-0.1085	1.5516
98°	-0.1485	1.0566	-0.1680	1.1955	-0.1861	1.3244	-0.2148	1.5284	-0.2271	1.6156
102°	-0.2251	1.0591	-0.2572	1.2102	-0.2875	1.3524	-0.3361	1.5813	-0.3572	1.6807
106°	-0.3040	1.0603	-0.3506	1.2226	-0.3953	1.3785	-0.4686	1.6343	-0.5010	1.7472
110°	-0.3861	1.0607	-0.4488	1.2330	-0.5106	1.4027	-0.6142	1.6875	-0.6608	1.8156
114°	-0.4723	1.0609	-0.5527	1.2415	-0.6346	1.4253	-0.7753	1.7414	-0.8400	1.8866
<u> </u>	<b></b>									

Table 1.- Concluded.

	IONOPAUSE		IONOPAUSE		IONOPAUSE		IONOPAUSE		IONOPAUSE	
	$\overline{H}/R_{O} = 0.01$		$\overline{H}/R_0 = 0.05$		$\overline{H}/R_{O} = 0.10$		$\overline{H}/R_0 = 0.20$		$\overline{H}/R_0 = 0.25$	
β	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o	x/R _o	Y _i /R _o
118° 122° 136° 134° 138° 142° 150° 154° 1574° 174°	-0.5641 -0.6630 -0.7708 -0.8903 -1.0246 -1.1783 -1.3580 -1.5730 -1.8377 -2.1754 -2.6262 -3.3654 -4.2564 -6.0204 -10.1111	1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610 1.0610	-0.6638 -0.7835 -0.9142 -1.0587 -1.2209 -1.4064 -1.6229 -1.8816 -2.18916 -2.6057 -3.1471 -3.9152 -5.1047 -7.2230 -12.1370	1.2539 1.2583 1.2617 1.2643 1.2664 1.2679 1.2701 1.2709 1.2715 1.2721 1.2727	-0.7690 -0.9159 -1.0782 -1.2597 -1.4654 -1.7027 -1.9817 -2.3176 -2.7338 -3.2686 -3.9884 -5.0210 -6.6450 -10.1609 -16.8192	1.4462 1.4657 1.4840 1.5012 1.5175 1.5331 1.5482 1.5784 1.5942 1.6114 1.6314 1.6568 1.7004 1.7678	-0.9551 -1.1578 -1.3890 -1.6562 -1.9703 -2.3465 -2.8081 -3.3909 -4.1545 -5.2045 -6.7470 -9.2448 -13.9882 -26.3596	1.7963 1.8529 1.9118 1.9738 2.0403 2.1128 2.1939 2.2872 2.3986 2.5384 2.7260 3.0038 3.4877 4.6480	-1.2746 -1.5434 -1.8598 -2.2393 -2.7047 -3.2913 -4.0570 -5.1025 -6.6208	1.9610 2.0397 2.1243 2.2165 2.3189 2.4353 2.5715 2.9460 3.2292 3.6484 4.3644 5.9630

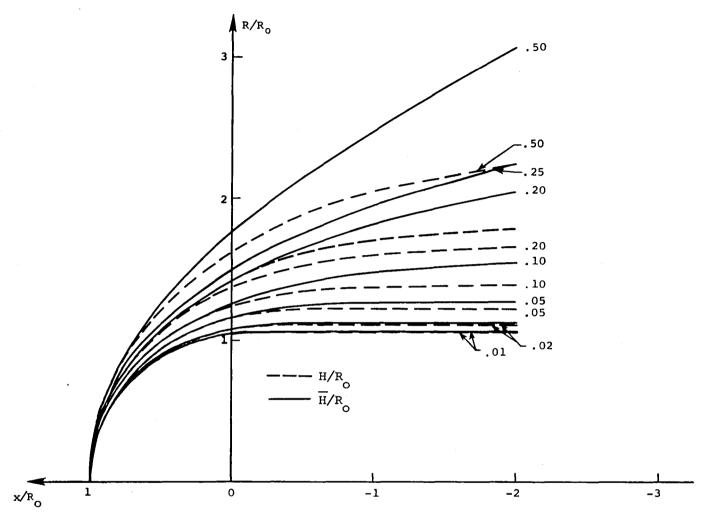
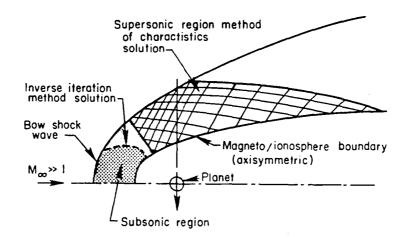
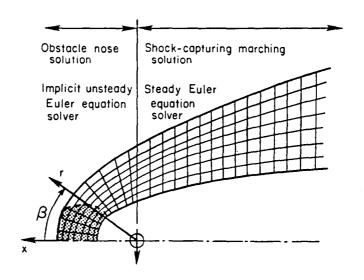


Figure 1.-Illustration of ionopause shapes for atmospheres with various (i) constant scale heights  $H/R_0$  and (ii) gravitational variation included in the scale height  $H/R_0$ .



(a) Former method.



(b) Present method.

Figure 2.- Comparison of former and present computational procedures for determining the gasdynamic flow properties of solar wind-magneto/ionopause interactions.

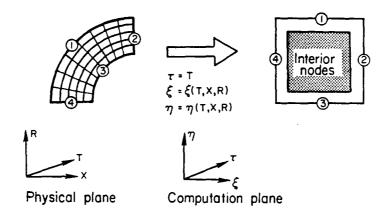


Figure 3.- Transformation from physical domain to rectangular computational domain.

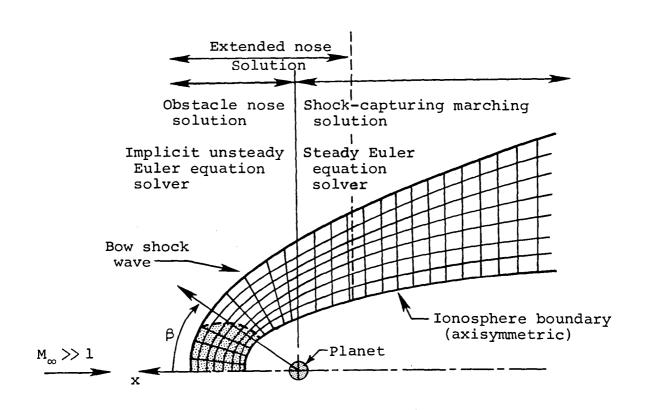


Figure 4.- Illustration of capability for providing an additional flow-field segment to the obstacle nose solution in the computational procedure for determining the gasdynamic flow properties of solar wind-ionopause interactions.

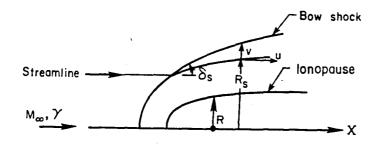


Figure 5.- Illustration of quantities used for streamline calculation.

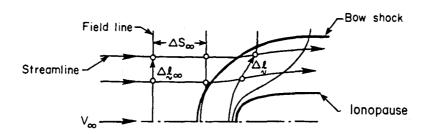


Figure 6.— Illustration of quantities used for magnetic field-line calculation in the plane of magnetic symmetry.

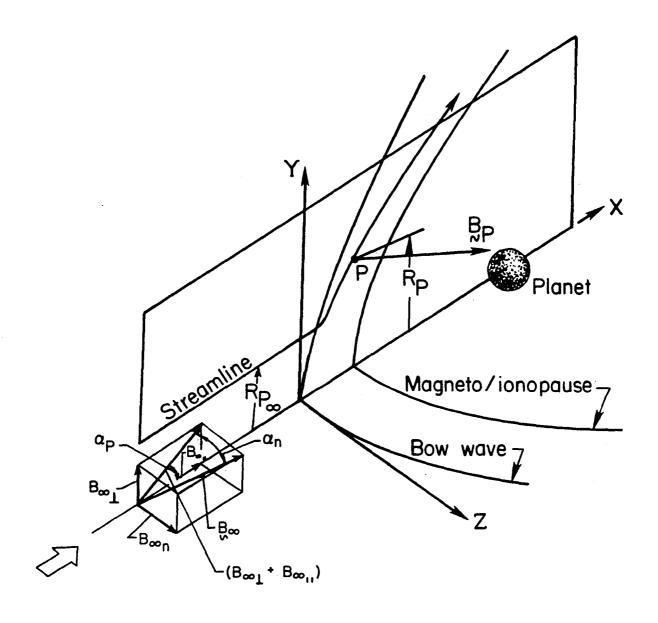


Figure 7.- Illustration of the components of the three-dimensional magnetic field.

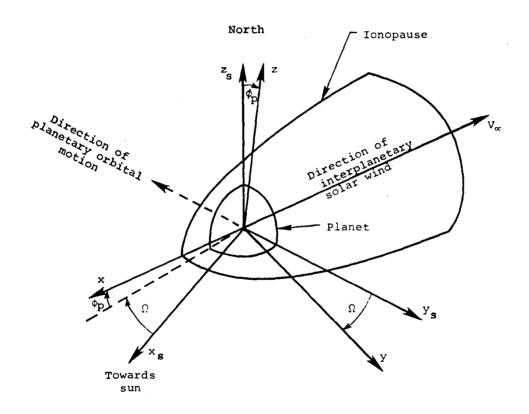


Figure 8.- Illustration of sun-planet  $(x_g, Y_s, z_s)$  and solar wind (x,y,z) coordinate systems and the azimuthal  $(\Omega)$  and polar  $(\phi_p)$  solar-wind angles, both shown in a positive sense.

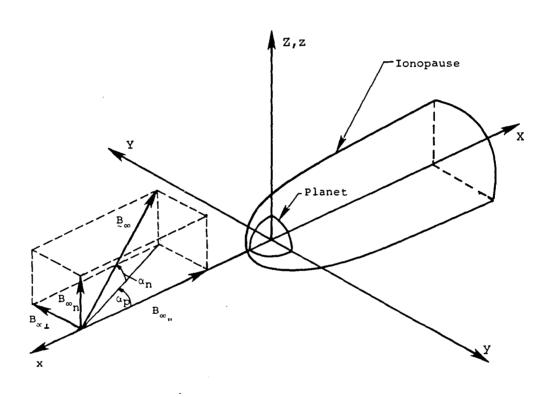


Figure 9.- Illustration of solar-wind (x,y,z) and (X,Y,Z) coordinate systems and the interplanetary magnetic field and magnetic-field angles ( $\alpha_p, \alpha_n$ ).

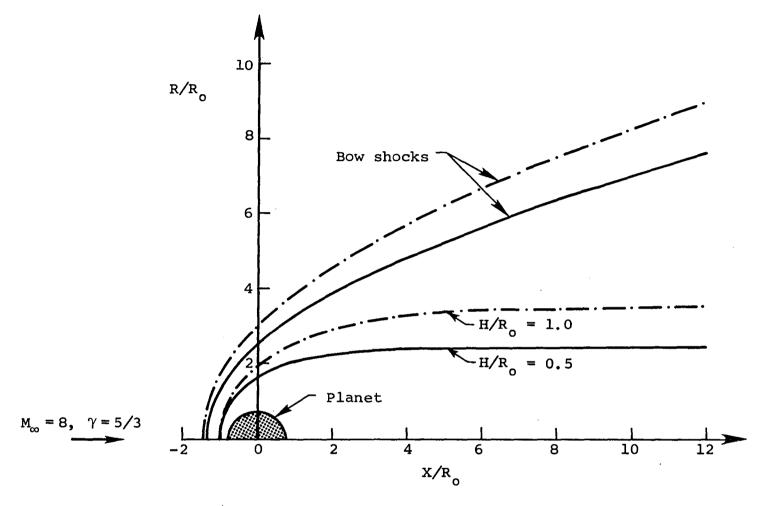


Figure 10. - Bow shock locations for  $M_{\infty}$  = 8.0,  $\gamma$  = 5/3 flow past constant scale-height ionopause shapes with H/R₀ = 0.5 and 1.0.

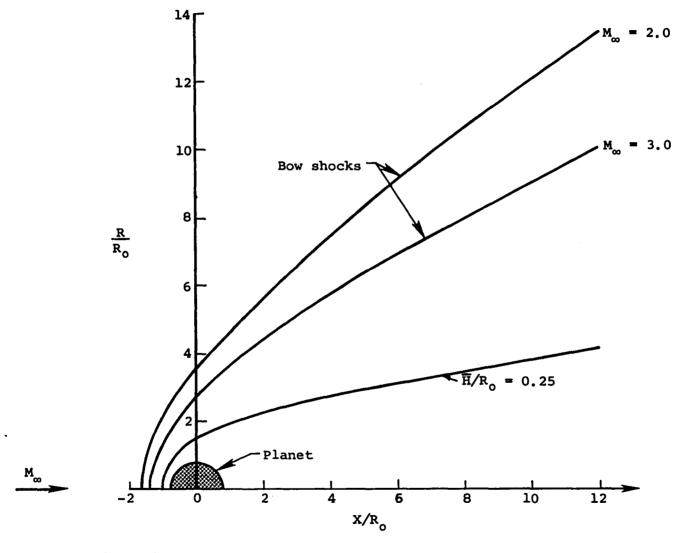


Figure 11.- Bow shock shapes for flow past an ionopause shape with gravitational variation included in scale height with  $H/R_0$  = 0.25,  $\gamma$  = 5/3 and  $M_\infty$  = 2.0 and 3.0.

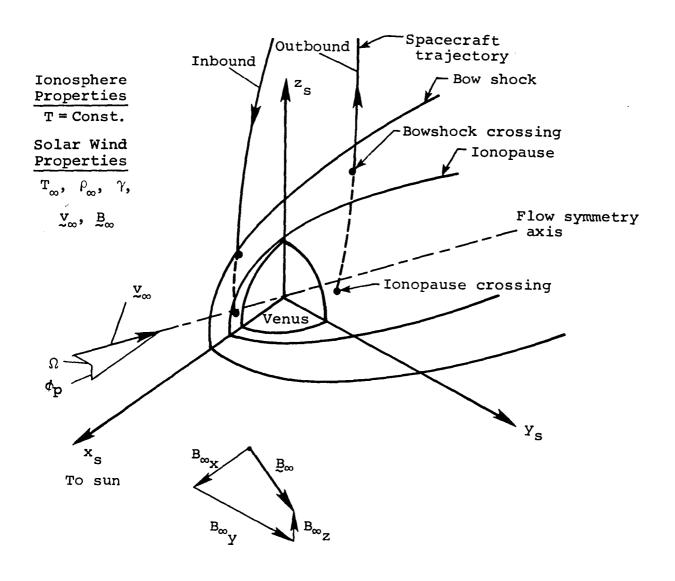


Figure 12.- Overall features of Pioneer-Venus orbiter trajectory crossings of solar-wind/Venus-ionosphere interaction region.

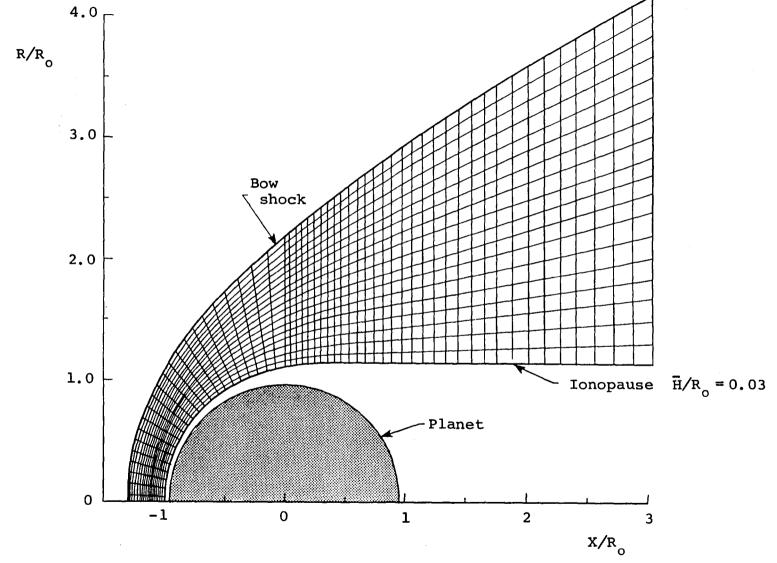


Figure 13.- Illustration of typical flow-field grid density for gasdynamic solution;  $M_{\infty} = 3.0$ ,  $\gamma = 5/3$ .

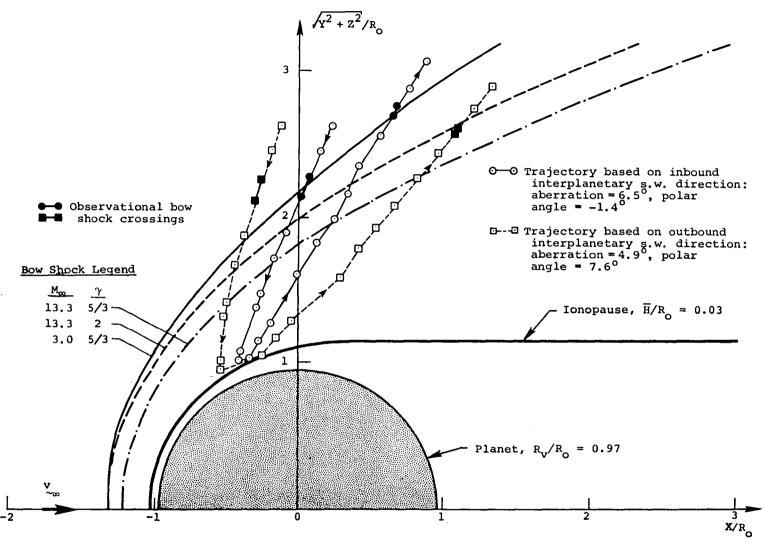


Figure 14.- P-V Orbit 6 trajectories and observational bow shock crossings as viewed in solar-wind coordinates based on inbound and outbound interplanetary solar-wind directions; also, various bow shock shapes for different interplanetary solar-wind conditions.

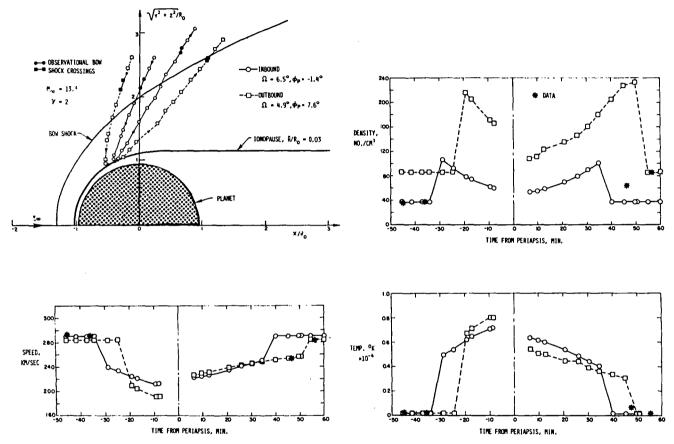


Figure 15.- Comparison of observed (OPA) and theoretical time histories of ionosheath plasma properties for P-V Orbit 6 based on inbound and outbound interplanetary solar-wind conditions using a gasdynamic solution for  $M_{\infty}$  = 13.3,  $\gamma$  = 2.0.

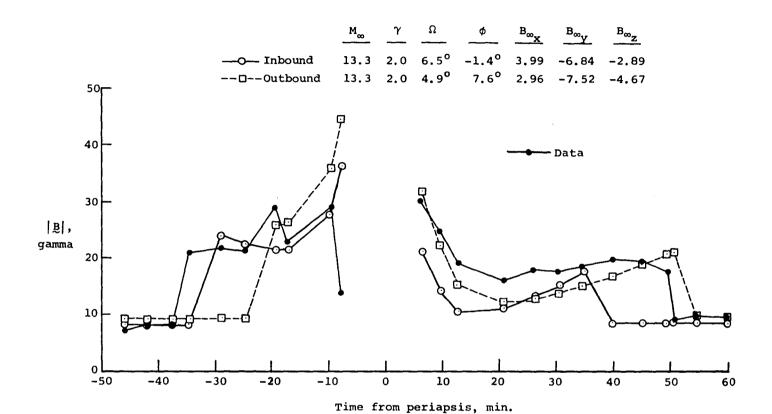
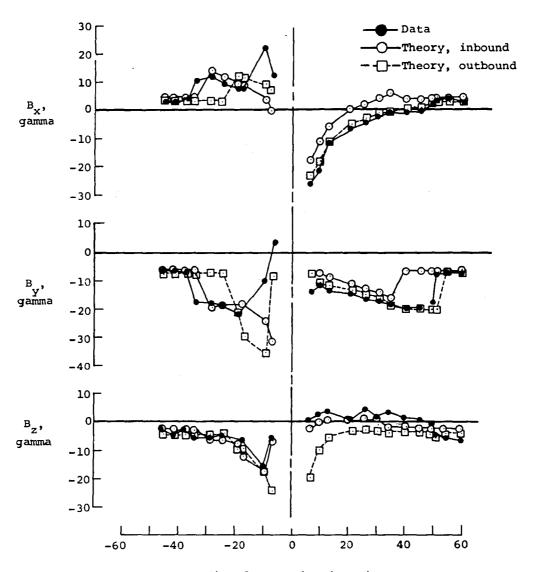


Figure 16.- Comparison of observed (OMAG) and theoretical time histories for the magnitude of the magnetic field for P-V Orbit 6 based on inbound and outbound interplanetary conditions using gasdynamic solution for  $\rm M_{\infty}$  = 13.3,  $\gamma$  = 2.

(a) Magnetic-field magnitude.



Time from periapsis, min.

(b) Magnetic-field components.

Figure 16. - Concluded.

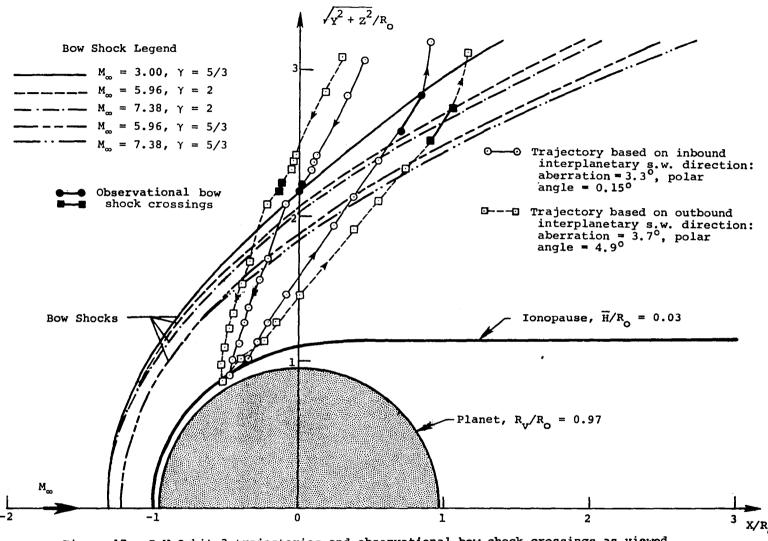


Figure 17.- P-V Orbit 3 trajectories and observational bow shock crossings as viewed in solar-wind coordinates based on inbound and outbound interplanetary solar-wind directions; also, various bow shock shapes for different interplanetary solar wind conditions.

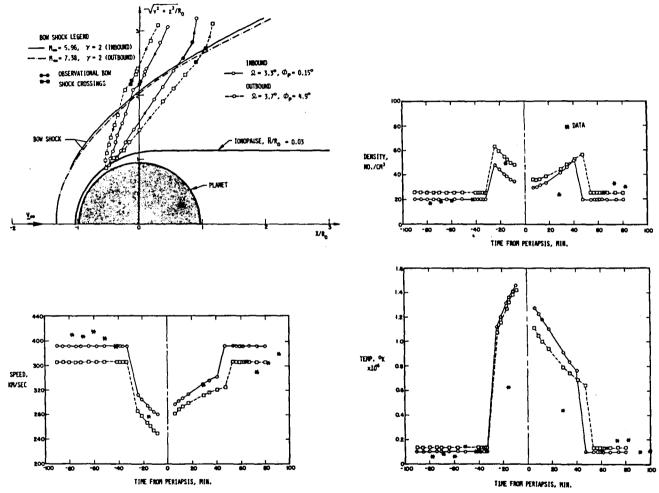
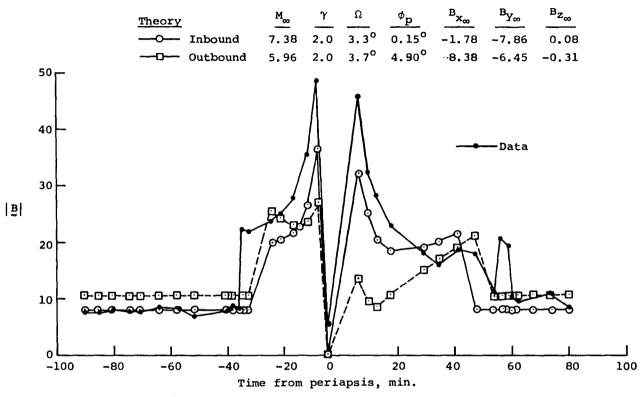
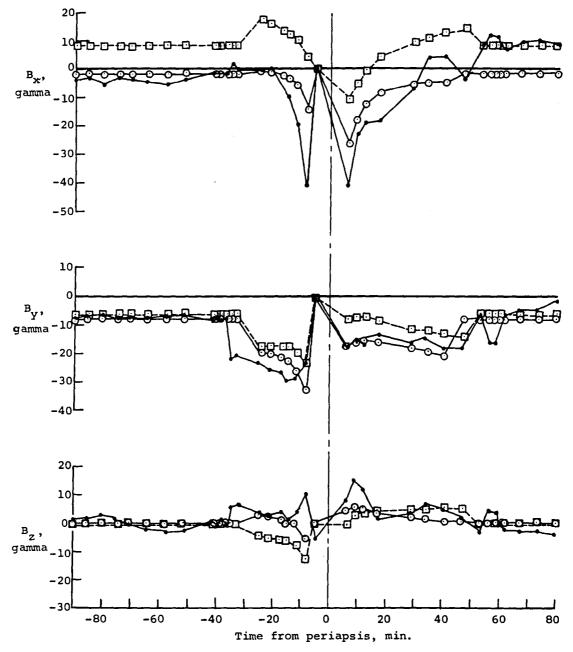


Figure 18.- Comparison of observed and theoretical time histories of ionosheath plasma properties for P-V Orbit 3 based on inbound and outbound interplanetary solar-wind conditions.



## (a) Magnetic-field magnitudes.

Figure 19.- Comparison of observed (OMAG) and theoretical time histories for the magnetic field for P-V Orbit 3 based on inbound and outbound interplanetary solar-wind conditions using gasdynamic solutions  $M_{\infty}$  = 7.38,  $\gamma$  = 2.0 for inbound and  $M_{\infty}$  = 5.96,  $\gamma$  = 2.0 for outbound calculations.

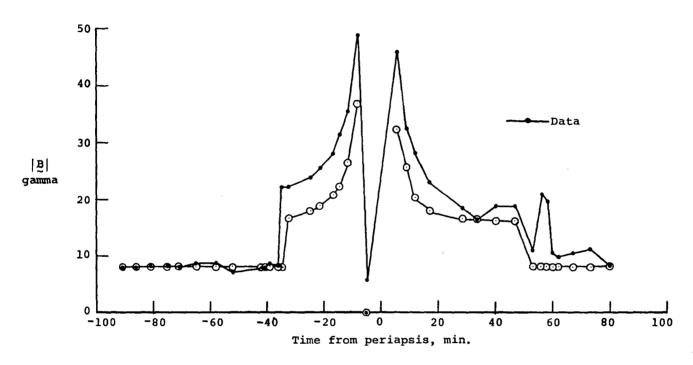


(b) Magnetic-field components.

Figure 19. - Concluded.

## Interplanetary Conditions

Theory 
$$\frac{M_{\infty}}{-0} = \frac{\gamma}{2} = \frac{\Omega}{2} = \frac{\phi_{p}}{2} = \frac{B_{x_{\infty}}}{2} = \frac{B_{y_{\infty}}}{2} = \frac{B_{z_{\infty}}}{2} = \frac{B_{z_{$$



# (a) Magnetic-field magnitude.

Figure 20.- Comparison of observed (OMAG) and theoretical time histories of the magnetic field for P-V Orbit 3 based on inbound solar wind interplanetary conditions using a gasdynamic solution for  $M_{\infty} = 3.0$ ,  $\gamma = 5/3$ .

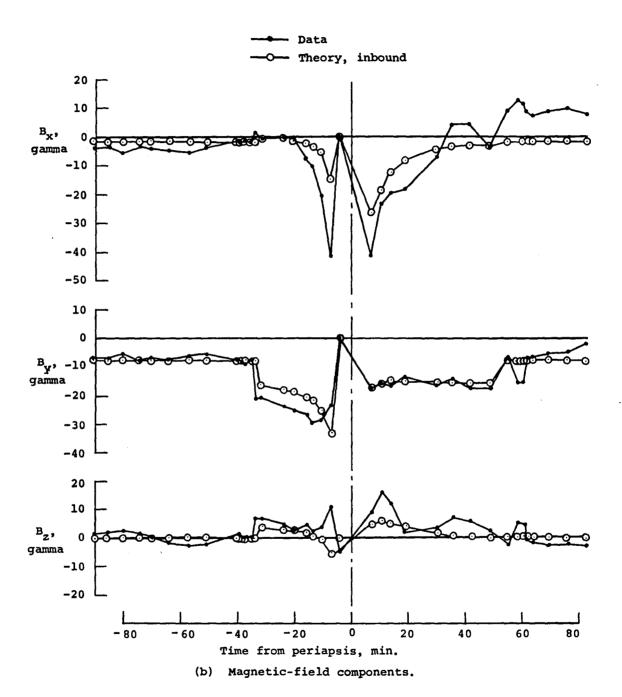


Figure 20. - Concluded.

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15. Supplementary Notes

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### 16. Abstract

Advanced computational procedures are developed and applied to the prediction of solar-wind interaction with nonmagnetic terrestrial-planet atmospheres, with particular emphasis to Venus. The theoretical method is based on a single-fluid, steady, dissipationless, magnetohydrodynamic continuum model, and is appropriate for the calculation of axisymmetric, supersonic, super-Alfvénic solar-wind flow past terrestrial planets. The procedures, which consist of finite-difference codes to determine the gasdynamic properties and a variety of special-purpose codes to determine the frozen magnetic field, streamlines, contours, plots, etc. of the flow, are organized into one computational program which has been extensively documented and is presented in a general user's manual included as part of this report.

Theoretical results based upon these procedures are reported for a wide variety of solar-wind conditions and ionopause obstacle shapes. Plasma and magnetic-field comparisons in the ionosheath are also provided with actual spacecraft data obtained by the Pioneer-Venus Orbiter. These results have verified the appropriateness of the basic theoretical model, and have indicated the importance of accounting for the variable oncoming direction of the interplanetary solar wind.

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